FIG. 1

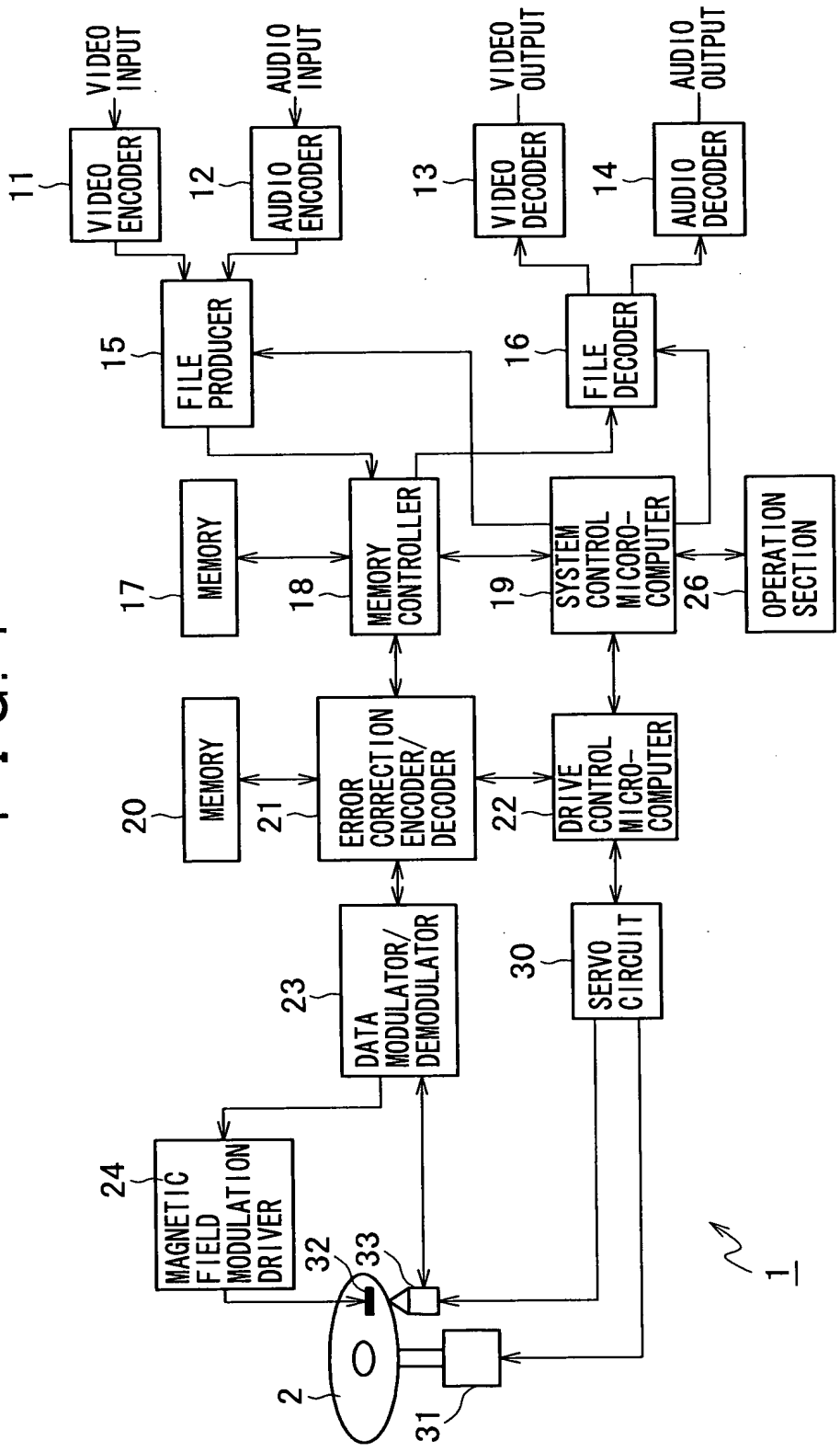

VIDEO INPUT
AUDIO INPUT
VIDEO OUTPUT
AUDIO OUTPUT
11 VIDEO ENCODER
12 AUDIO ENCODER
13 VIDEO DECODER
14 AUDIO DECODER
15 FILE PRODUCER
16 FILE DECODER
17 MEMORY
18 MEMORY CONTROLLER
19 SYSTEM CONTROL MICORO-COMPUTER
26 OPERATION SECTION
20 MEMORY
21 ERROR CORRECTION ENCODER/ DECODER
22 DRIVE CONTROL MICRO-COMPUTER
23 DATA MODULATOR/ DEMODULATOR
30 SERVO CIRCUIT
24 MAGNETIC FIELD MODULATION DRIVER
32
33
2
31
1

FIG. 2

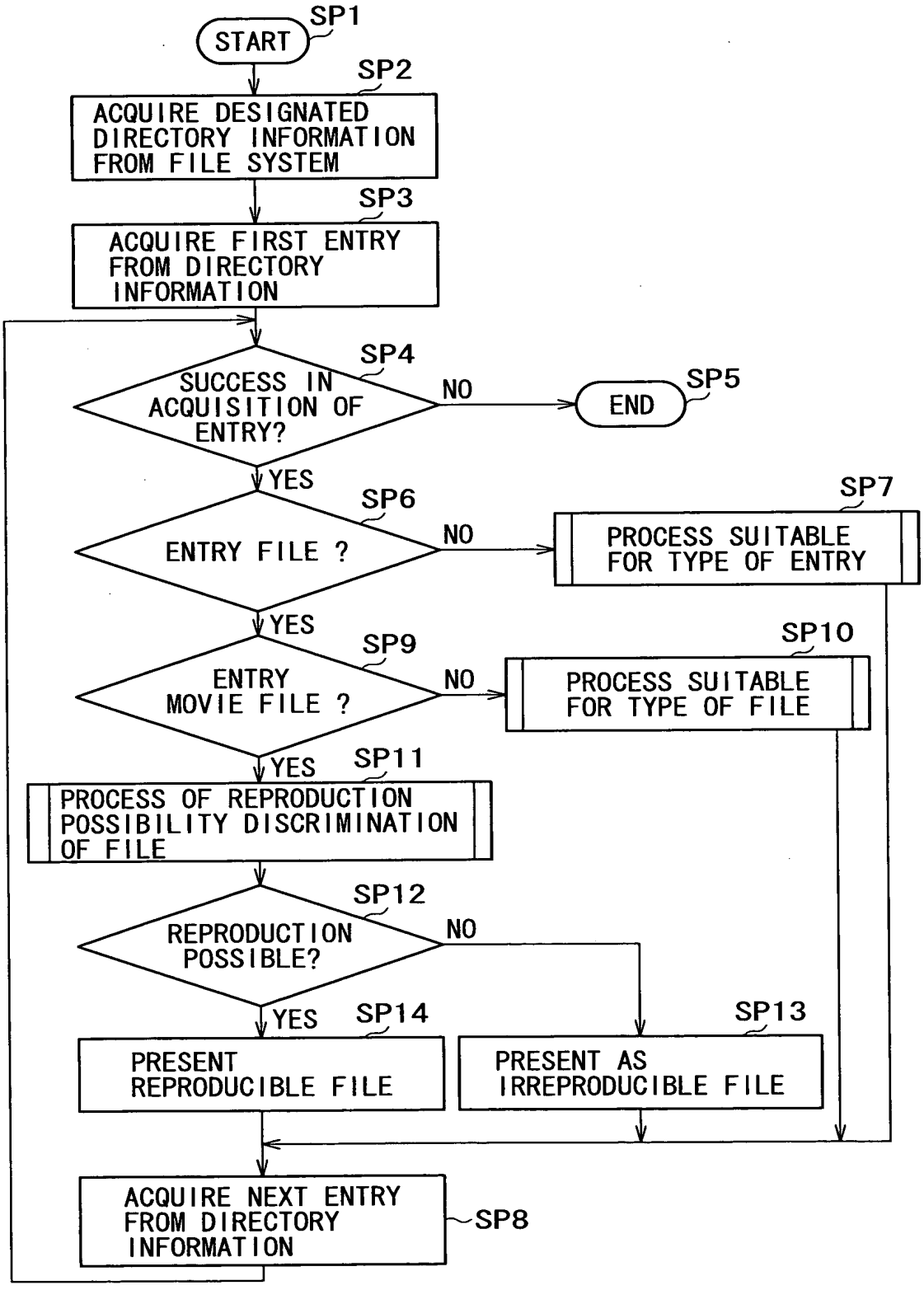

START
SP1
SP2
ACQUIRE DESIGNATED DIRECTORY INFORMATION FROM FILE SYSTEM
SP3
ACQUIRE FIRST ENTRY FROM DIRECTORY INFORMATION
SP4
SUCCESS IN ACQUISITION OF ENTRY?
NO
END
SP5
YES
SP6
ENTRY FILE ?
NO
SP7
PROCESS SUITABLE FOR TYPE OF ENTRY
YES
SP9
ENTRY MOVIE FILE ?
NO
SP10
PROCESS SUITABLE FOR TYPE OF FILE
YES
SP11
PROCESS OF REPRODUCTION POSSIBILITY DISCRIMINATION OF FILE
SP12
REPRODUCTION POSSIBLE?
NO
YES
SP14
PRESENT REPRODUCIBLE FILE
SP13
PRESENT AS IRREPRODUCIBLE FILE
ACQUIRE NEXT ENTRY FROM DIRECTORY INFORMATION
SP8

FIG. 3

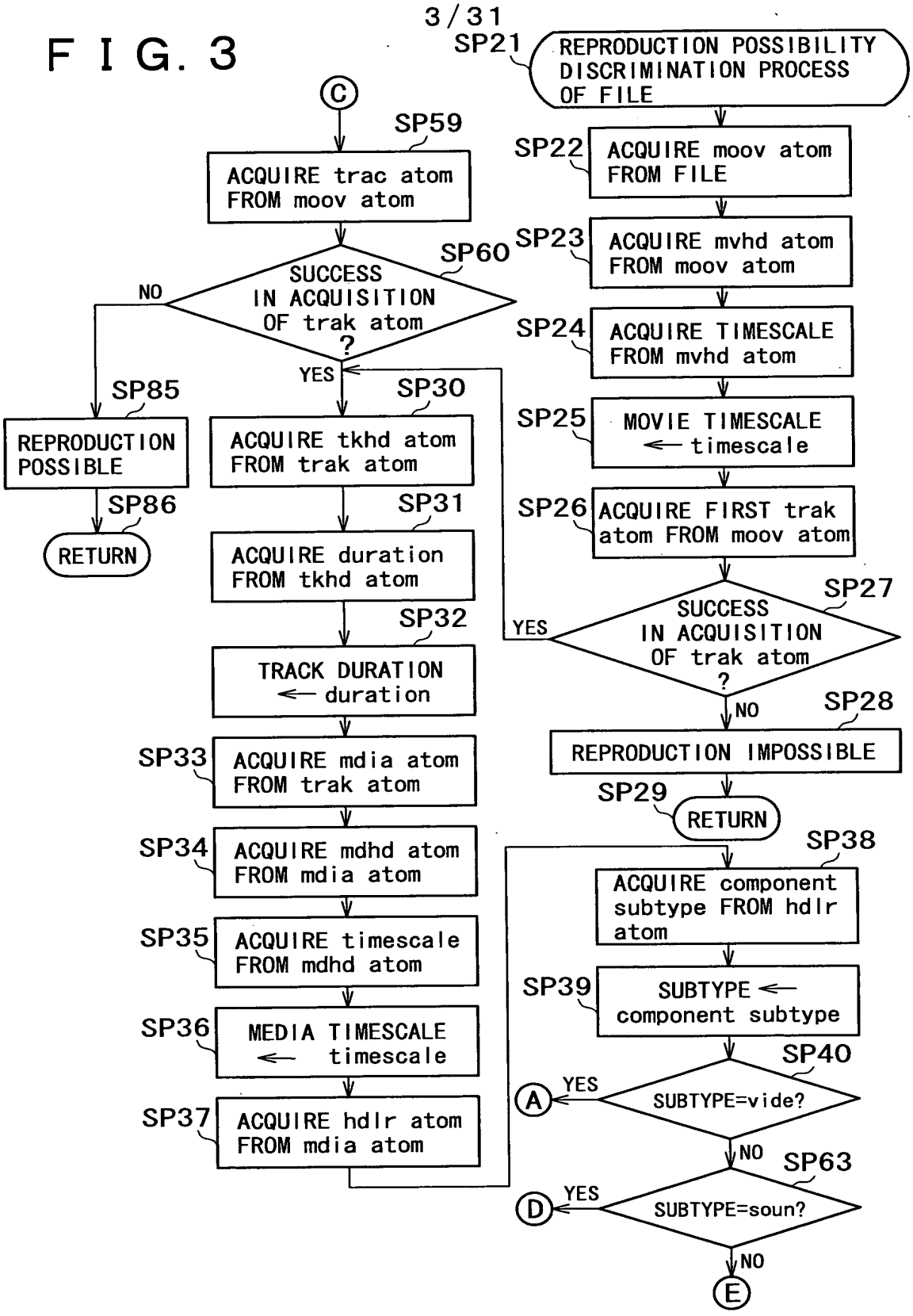

SP21
REPRODUCTION POSSIBILITY DISCRIMINATION PROCESS OF FILE
SP22
ACQUIRE moov atom FROM FILE
SP23
ACQUIRE mvhd atom FROM moov atom
SP24
ACQUIRE TIMESCALE FROM mvhd atom
SP25
MOVIE TIMESCALE ← timescale
SP26
ACQUIRE FIRST trak atom FROM moov atom
SP27
SUCCESS IN ACQUISITION OF trak atom ?
YES
NO
SP28
REPRODUCTION IMPOSSIBLE
SP29
RETURN
SP38
ACQUIRE component subtype FROM hdlr atom
SP39
SUBTYPE ← component subtype
SP40
SUBTYPE=vide?
YES
A
NO
SP63
SUBTYPE=soun?
YES
D
NO
E
C
SP59
ACQUIRE trac atom FROM moov atom
SP60
SUCCESS IN ACQUISITION OF trak atom ?
NO
YES
SP85
REPRODUCTION POSSIBLE
SP86
RETURN
SP30
ACQUIRE tkhd atom FROM trak atom
SP31
ACQUIRE duration FROM tkhd atom
SP32
TRACK DURATION ← duration
SP33
ACQUIRE mdia atom FROM trak atom
SP34
ACQUIRE mdhd atom FROM mdia atom
SP35
ACQUIRE timescale FROM mdhd atom
SP36
MEDIA TIMESCALE ← timescale
SP37
ACQUIRE hdlr atom FROM mdia atom

FIG. 4

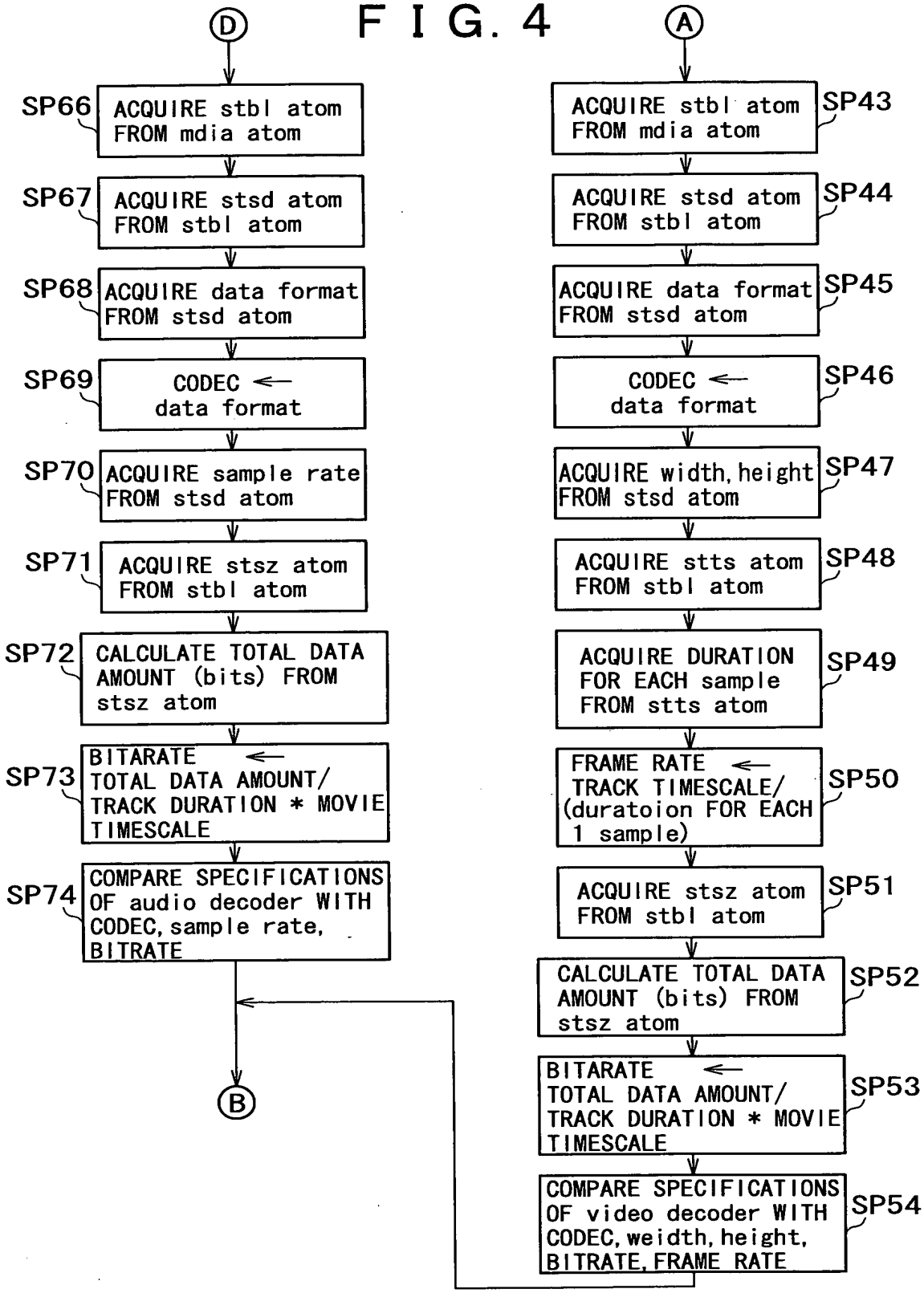

A
ACQUIRE stbl atom FROM mdia atom
SP43
ACQUIRE stsd atom FROM stbl atom
SP44
ACQUIRE data format FROM stsd atom
SP45
CODEC ← data format
SP46
ACQUIRE width, height FROM stsd atom
SP47
ACQUIRE stts atom FROM stbl atom
SP48
ACQUIRE DURATION FOR EACH sample FROM stts atom
SP49
FRAME RATE ← TRACK TIMESCALE/ (duratoion FOR EACH 1 sample)
SP50
ACQUIRE stsz atom FROM stbl atom
SP51
CALCULATE TOTAL DATA AMOUNT (bits) FROM stsz atom
SP52
BITARATE ← TOTAL DATA AMOUNT/ TRACK DURATION * MOVIE TIMESCALE
SP53
COMPARE SPECIFICATIONS OF video decoder WITH CODEC, weidth, height, BITRATE, FRAME RATE
SP54
B
D
ACQUIRE stbl atom FROM mdia atom
SP66
ACQUIRE stsd atom FROM stbl atom
SP67
ACQUIRE data format FROM stsd atom
SP68
CODEC ← data format
SP69
ACQUIRE sample rate FROM stsd atom
SP70
ACQUIRE stsz atom FROM stbl atom
SP71
CALCULATE TOTAL DATA AMOUNT (bits) FROM stsz atom
SP72
BITARATE ← TOTAL DATA AMOUNT/ TRACK DURATION * MOVIE TIMESCALE
SP73
COMPARE SPECIFICATIONS OF audio decoder WITH CODEC, sample rate, BITRATE
SP74

FIG. 5

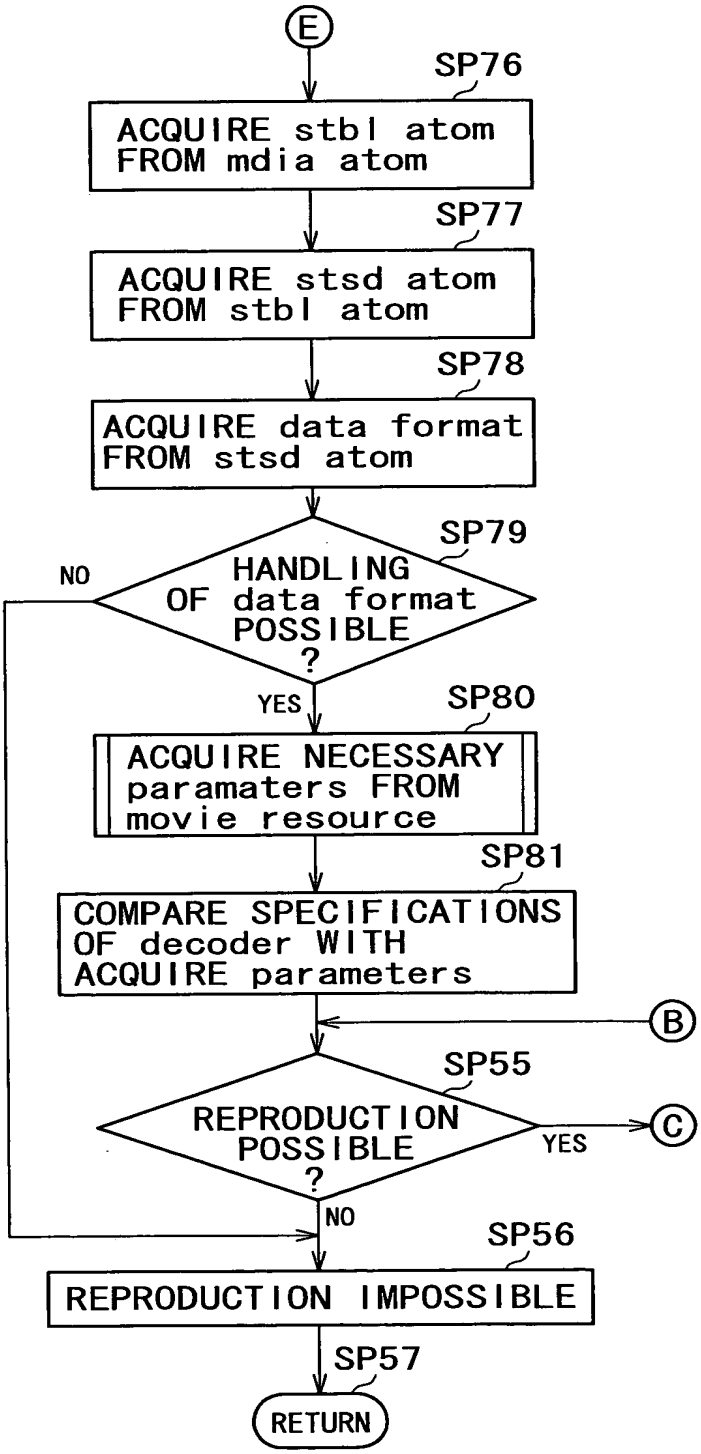

E
SP76
ACQUIRE stbl atom FROM mdia atom
SP77
ACQUIRE stsd atom FROM stbl atom
SP78
ACQUIRE data format FROM stsd atom
SP79
HANDLING OF data format POSSIBLE ?
NO
YES
SP80
ACQUIRE NECESSARY paramaters FROM movie resource
SP81
COMPARE SPECIFICATIONS OF decoder WITH ACQUIRE parameters
B
SP55
REPRODUCTION POSSIBLE ?
YES
C
NO
SP56
REPRODUCTION IMPOSSIBLE
SP57
RETURN

FIG. 6

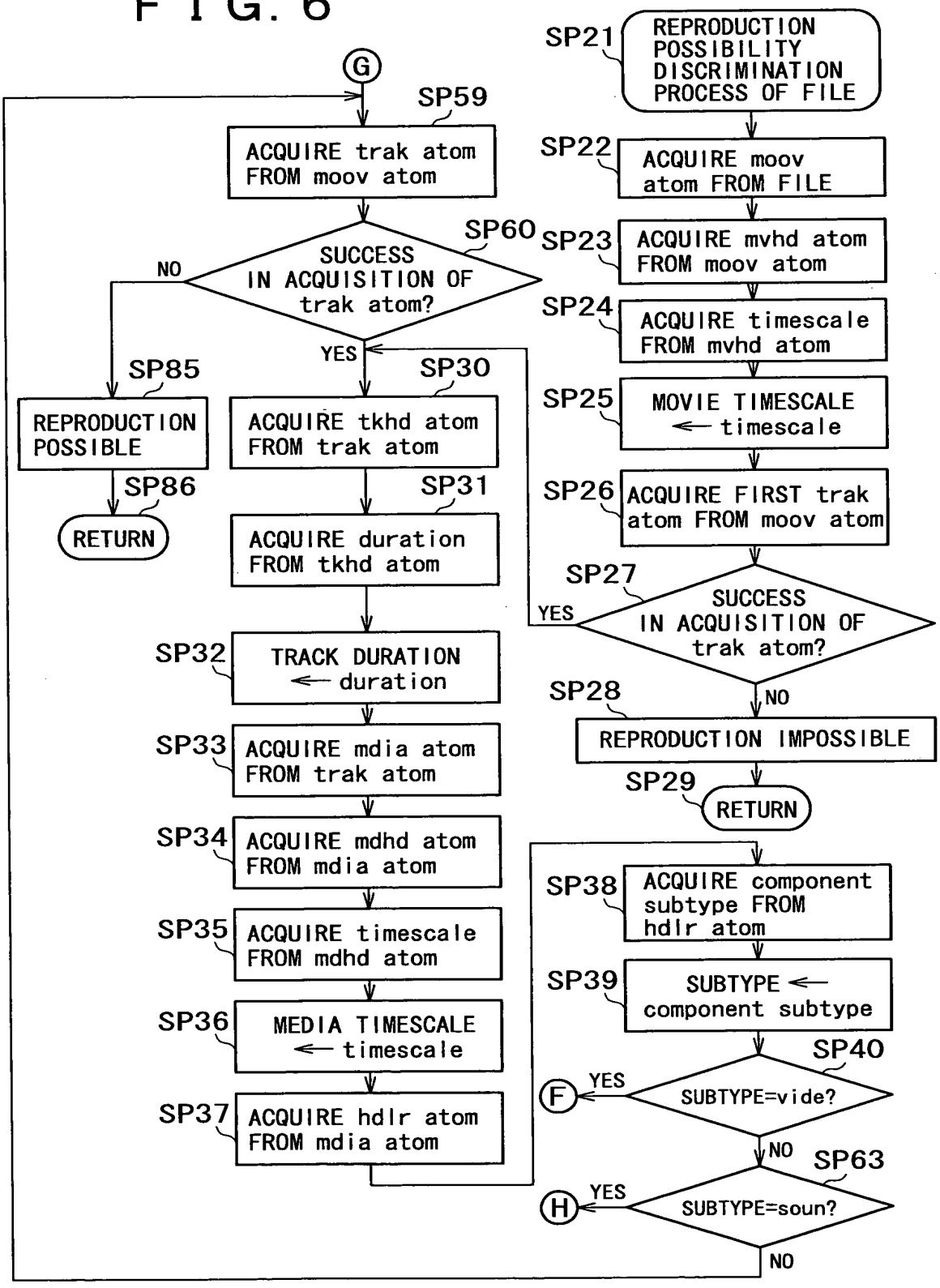

SP21
REPRODUCTION POSSIBILITY DISCRIMINATION PROCESS OF FILE
SP22
ACQUIRE moov atom FROM FILE
SP23
ACQUIRE mvhd atom FROM moov atom
SP24
ACQUIRE timescale FROM mvhd atom
SP25
MOVIE TIMESCALE ← timescale
SP26
ACQUIRE FIRST trak atom FROM moov atom
SP27
SUCCESS IN ACQUISITION OF trak atom?
YES
NO
SP28
REPRODUCTION IMPOSSIBLE
SP29
RETURN
G
SP59
ACQUIRE trak atom FROM moov atom
SP60
SUCCESS IN ACQUISITION OF trak atom?
NO
YES
SP85
REPRODUCTION POSSIBLE
SP86
RETURN
SP30
ACQUIRE tkhd atom FROM trak atom
SP31
ACQUIRE duration FROM tkhd atom
SP32
TRACK DURATION ← duration
SP33
ACQUIRE mdia atom FROM trak atom
SP34
ACQUIRE mdhd atom FROM mdia atom
SP35
ACQUIRE timescale FROM mdhd atom
SP36
MEDIA TIMESCALE ← timescale
SP37
ACQUIRE hdlr atom FROM mdia atom
SP38
ACQUIRE component subtype FROM hdlr atom
SP39
SUBTYPE ← component subtype
SP40
SUBTYPE=vide?
YES
F
NO
SP63
SUBTYPE=soun?
YES
H
NO

FIG. 7

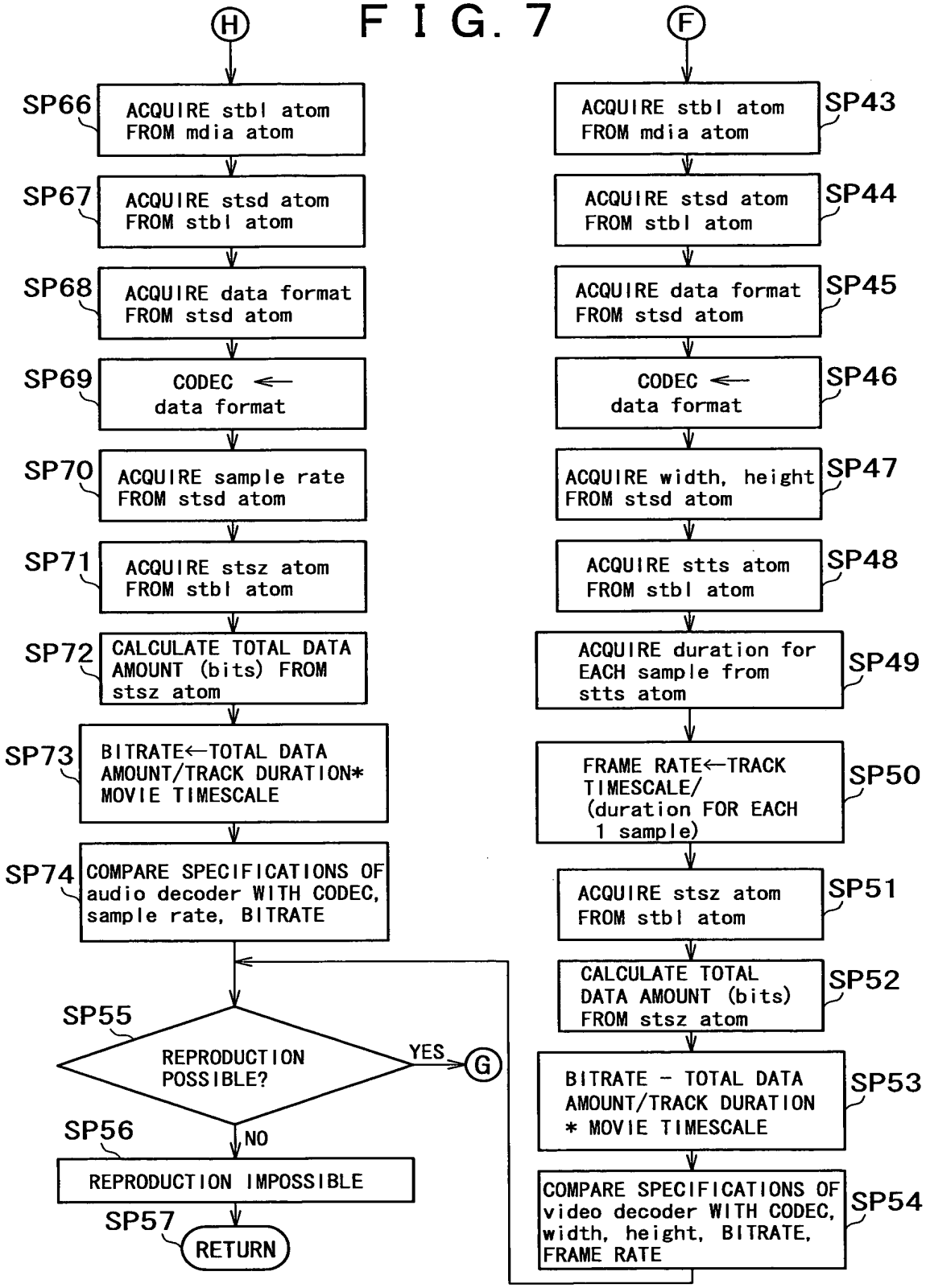

H
SP66
ACQUIRE stbl atom FROM mdia atom
SP67
ACQUIRE stsd atom FROM stbl atom
SP68
ACQUIRE data format FROM stsd atom
SP69
CODEC ← data format
SP70
ACQUIRE sample rate FROM stsd atom
SP71
ACQUIRE stsz atom FROM stbl atom
SP72
CALCULATE TOTAL DATA AMOUNT (bits) FROM stsz atom
SP73
BITRATE←TOTAL DATA AMOUNT/TRACK DURATION* MOVIE TIMESCALE
SP74
COMPARE SPECIFICATIONS OF audio decoder WITH CODEC, sample rate, BITRATE
SP55
REPRODUCTION POSSIBLE?
YES
G
SP56
NO
REPRODUCTION IMPOSSIBLE
SP57
RETURN
F
SP43
ACQUIRE stbl atom FROM mdia atom
SP44
ACQUIRE stsd atom FROM stbl atom
SP45
ACQUIRE data format FROM stsd atom
SP46
CODEC ← data format
SP47
ACQUIRE width, height FROM stsd atom
SP48
ACQUIRE stts atom FROM stbl atom
SP49
ACQUIRE duration for EACH sample from stts atom
SP50
FRAME RATE←TRACK TIMESCALE/ (duration FOR EACH 1 sample)
SP51
ACQUIRE stsz atom FROM stbl atom
SP52
CALCULATE TOTAL DATA AMOUNT (bits) FROM stsz atom
SP53
BITRATE - TOTAL DATA AMOUNT/TRACK DURATION * MOVIE TIMESCALE
SP54
COMPARE SPECIFICATIONS OF video decoder WITH CODEC, width, height, BITRATE, FRAME RATE

FIG. 8

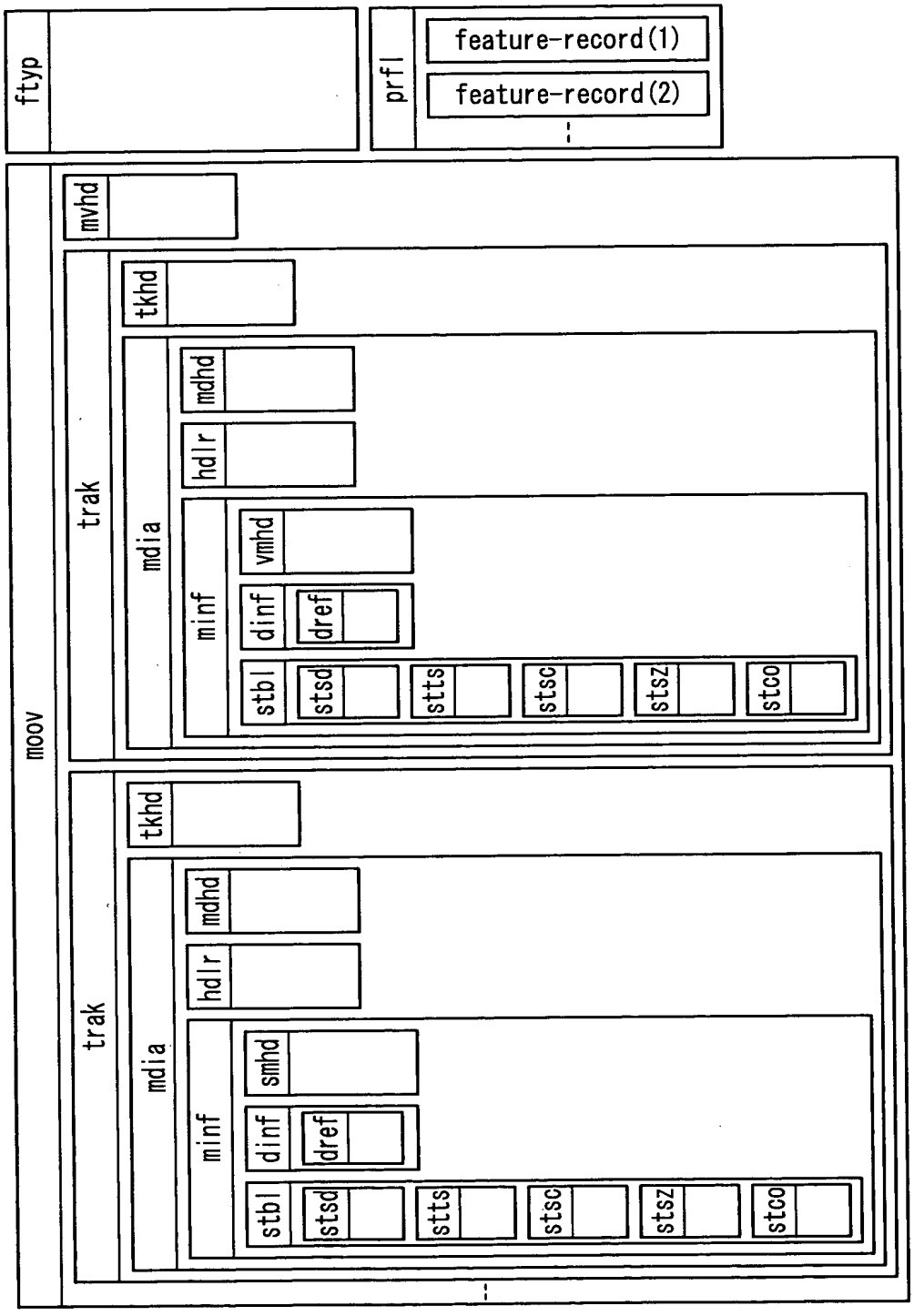

ftyp
prfl
feature-record(1)
feature-record(2)
moov
mvhd
trak
tkhd
mdia
mdhd
hdlr
minf
vmhd
dinf
dref
stbl
stsd
stts
stsc
stsz
stco
trak
tkhd
mdia
mdhd
hdlr
minf
smhd
dinf
dref
stbl
stsd
stts
stsc
stsz
stco

FIG. 9

syntax	Size [bytes]
File Type Compatible Atom {	
atom size	4
atom type = ftyp	4
Major Brand	4
Minor Version	4
/* Compatible Brand */	
for (i = 0; i < N; i++) {	
Brand	4
}	
}	

FIG. 10

syntax	Size [bytes]
Profile Atom {	
atom size	4
atom type = prfl	4
Version	1
flags	3
feature-record-count	4
/* feature-record-list */	
for (i = 0; i < feature-record-count; i++) {	
track-ID	4
sub-part-ID	4
feature	4
value	4
}	
}	

FIG. 11

feature	MEANING	value (EXAMPLE)
cdty	TYPE OF CODEC	mp4v (MPEG4 video), mp4a (MPEG4 audio)
brat	BIT RATE OF DATA	64000, 96000, 128000, 192000, 384000 [bps]
frat	VIDEO FRAME RATE	10, 15, 24, 30 [fps]
srat	AUDIO SAMPLING FREQUENCY	24000, 48000 [Hz]
wdth	VIDEO PICTURE SIZE (HORIZONTAL)	176, 352, 704, 720
hght	VIDEO PICTURE SIZE (VERTICAL)	120, 144, 240, 288, 480, 576
frty	FIXED FRAME OR VARIABLE FRAME	cfr (FXED frame rate), vfr (VARIABLE frame rate)
brty	FIXED BIT RATE OR VARIABLE BIT RATE	cbr (FXED bit rate), vbr (VARIABLE bit rate)

FIG. 12

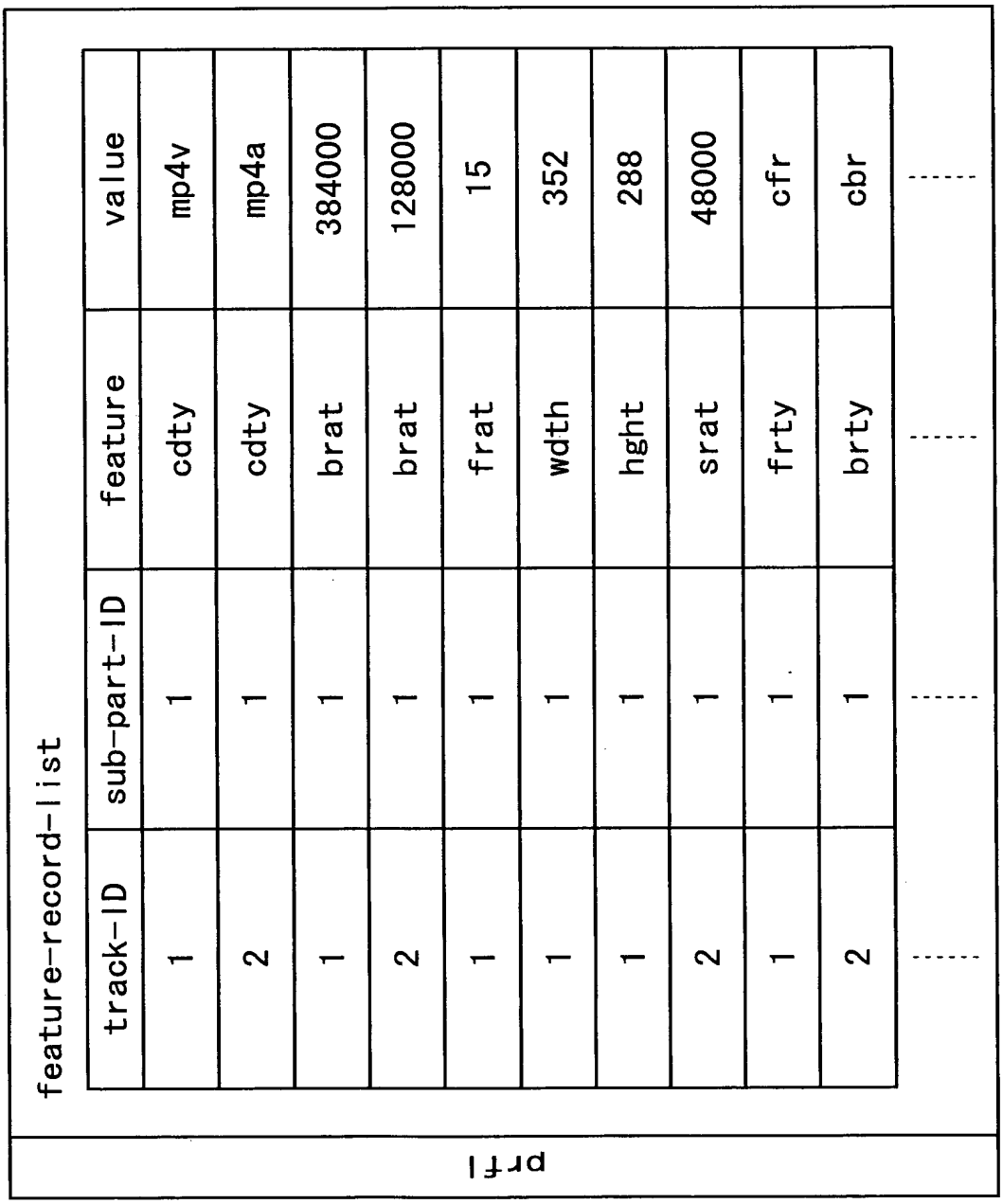

prfi
feature-record-list
track-ID
sub-part-ID
feature
value
1
1
cdty
mp4v
2
1
cdty
mp4a
1
1
brat
384000
2
1
brat
128000
1
1
frat
15
1
1
wdth
352
1
1
hght
288
2
1
srat
48000
1
1
frty
cfr
2
1
brty
cbr

FIG. 13

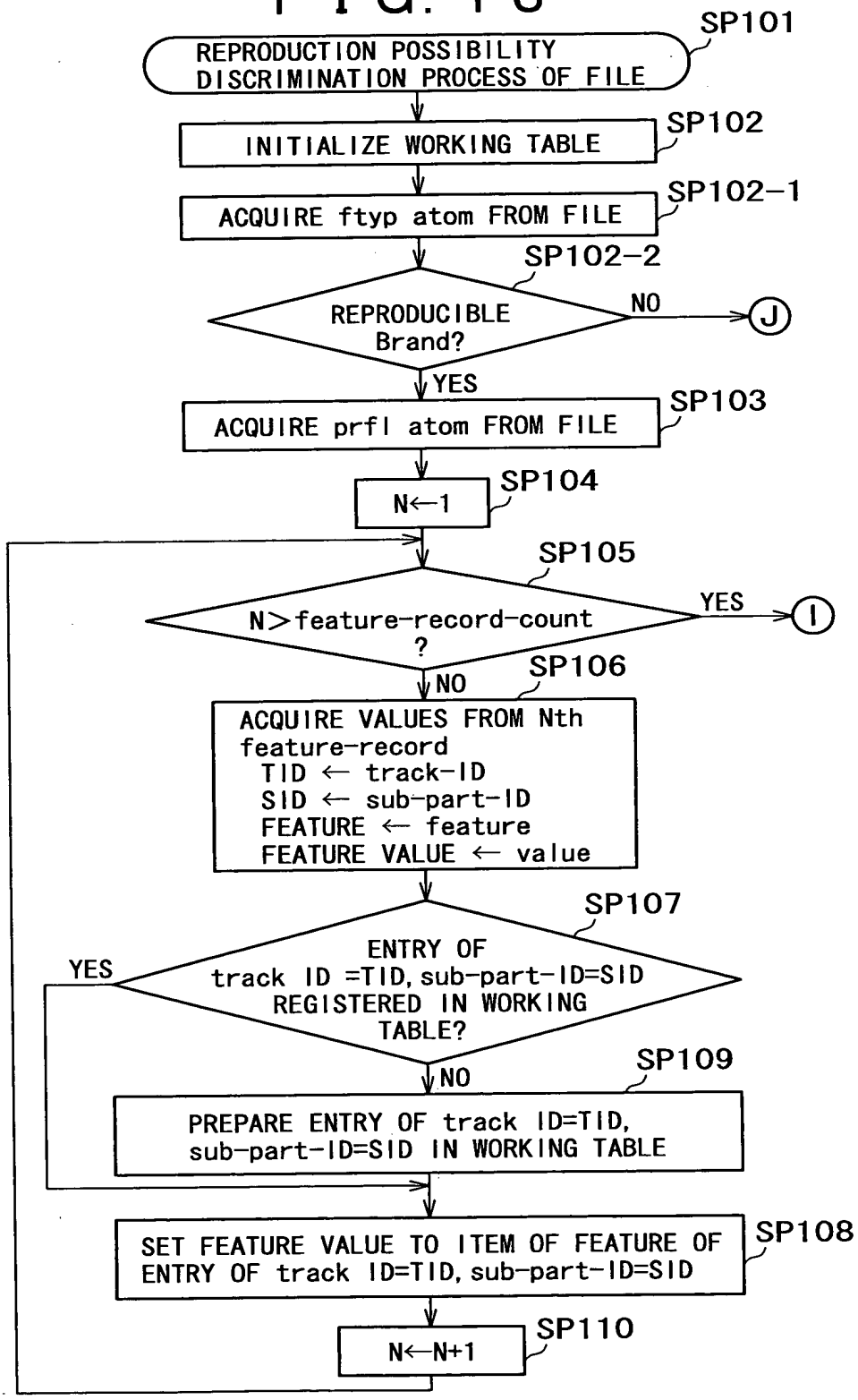

SP101
REPRODUCTION POSSIBILITY DISCRIMINATION PROCESS OF FILE
SP102
INITIALIZE WORKING TABLE
SP102-1
ACQUIRE ftyp atom FROM FILE
SP102-2
REPRODUCIBLE Brand?
NO
J
YES
SP103
ACQUIRE prfl atom FROM FILE
SP104
N←1
SP105
N>feature-record-count ?
YES
I
NO
SP106
ACQUIRE VALUES FROM Nth feature-record
TID ← track-ID
SID ← sub-part-ID
FEATURE ← feature
FEATURE VALUE ← value
SP107
ENTRY OF track ID =TID, sub-part-ID=SID REGISTERED IN WORKING TABLE?
YES
NO
SP109
PREPARE ENTRY OF track ID=TID, sub-part-ID=SID IN WORKING TABLE
SP108
SET FEATURE VALUE TO ITEM OF FEATURE OF ENTRY OF track ID=TID, sub-part-ID=SID
SP110
N←N+1

FIG. 14

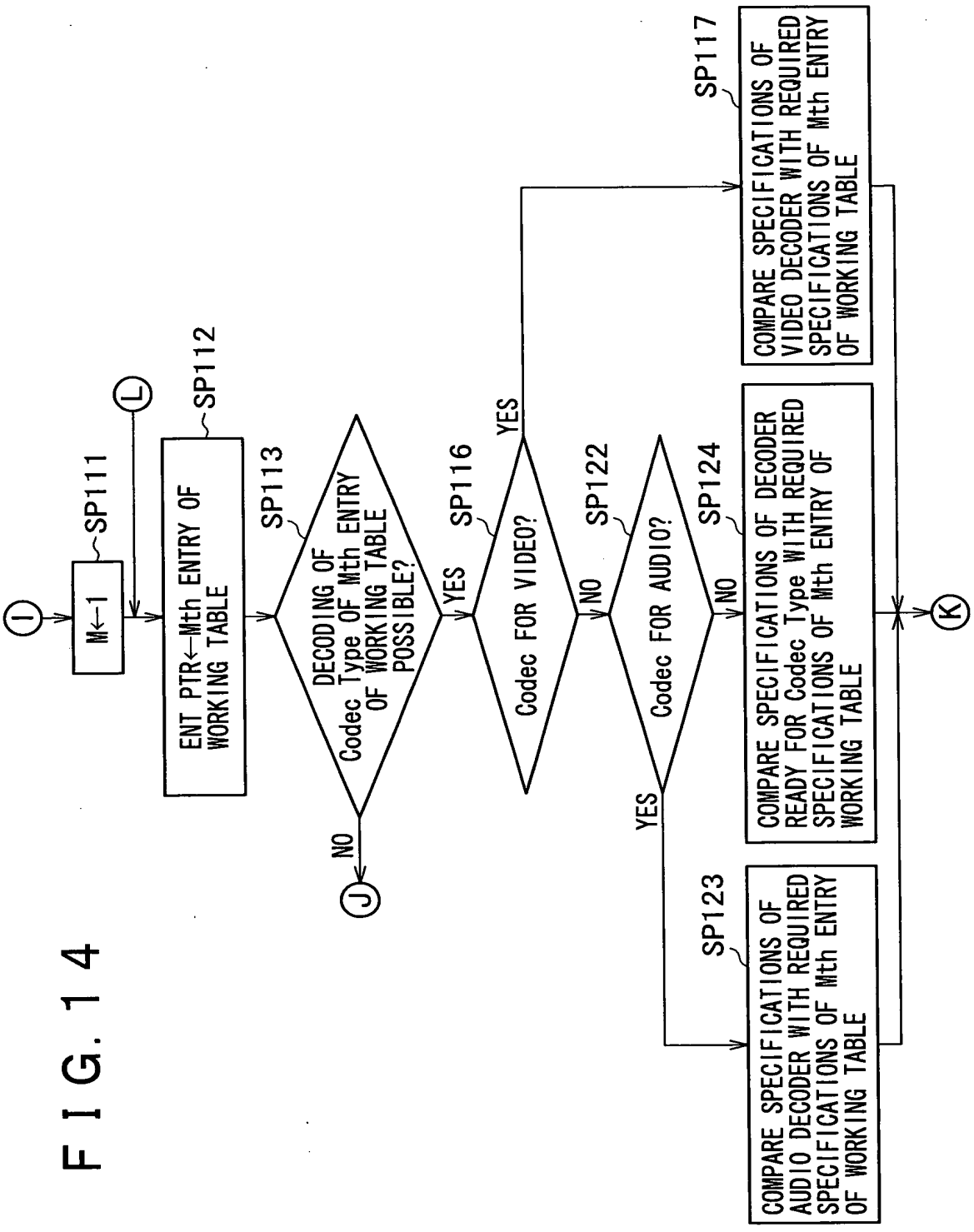

I
SP111
M←1
L
SP112
ENT PTR←Mth ENTRY OF WORKING TABLE
SP113
DECODING OF Codec Type OF Mth ENTRY OF WORKING TABLE POSSIBLE?
NO
J
YES
SP116
Codec FOR VIDEO?
YES
SP117
COMPARE SPECIFICATIONS OF VIDEO DECODER WITH REQUIRED SPECIFICATIONS OF Mth ENTRY OF WORKING TABLE
NO
SP122
Codec FOR AUDIO?
YES
SP123
COMPARE SPECIFICATIONS OF AUDIO DECODER WITH REQUIRED SPECIFICATIONS OF Mth ENTRY OF WORKING TABLE
NO
SP124
COMPARE SPECIFICATIONS OF DECODER READY FOR Codec Type WITH REQUIRED SPECIFICATIONS OF Mth ENTRY OF WORKING TABLE
K

FIG. 15

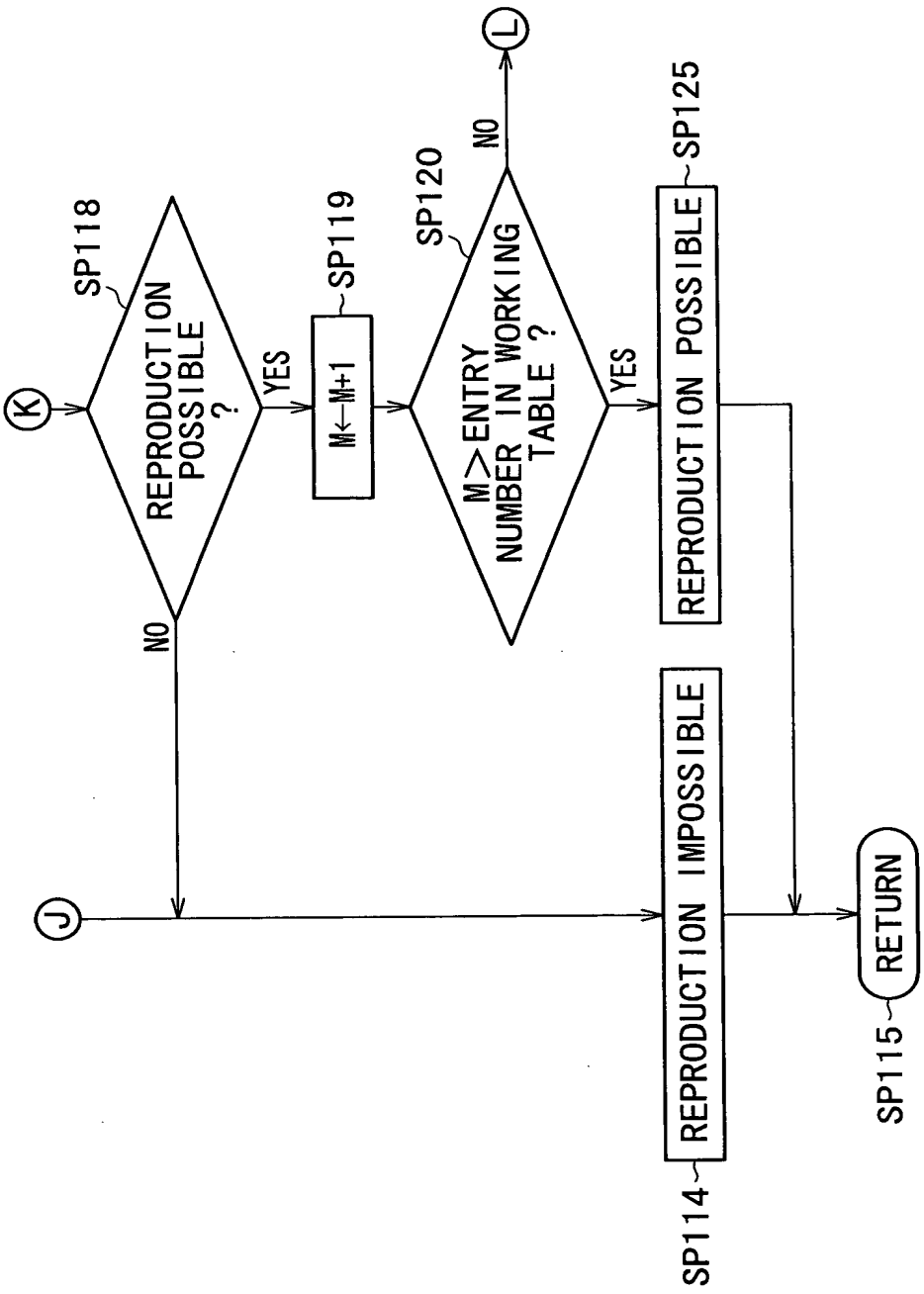

K
SP118
REPRODUCTION POSSIBLE ?
YES
NO
SP119
M←M+1
SP120
M>ENTRY NUMBER IN WORKING TABLE ?
YES
NO
L
SP125
REPRODUCTION POSSIBLE
J
SP114
REPRODUCTION IMPOSSIBLE
SP115
RETURN

FIG. 16

Entry No.	track -ID	sub-part -ID	Codec Type	REQUIRED SPECIFICATIONS						
				bit rate	frame rate	PICTURE SIZE (HORIZONTAL)	PICTURE SIZE (VERTICAL)	sample rate	VARIABLE frame rate	VARIABLE bit rate
1	1	1	mp4v	384000	15	352	288	—	No	—
2	2	1	mp4a	128000	—	—	—	48000	—	No
---	---	---	---	---	---	---	---	---	---	---

FIG. 17

Bit	SIGNIFICANCE OF bit field	VALUE (EXAMPLE) (BINARY NUMBER)	SIGNIFICANCE OF VALUE (EXAMPLE)
31:26	TYPE OF Video Codec	001000 OTHERS	MPEG4 Video Simple Profile reserved
25:24	frame rate CODE	01 10 OTHERS	10fps 15fps reserved
23	variable frame rate FLAG	0 1	FIXED frame rate VARIABLE frame rate
22:20	bit rate CODE	010 100 110 OTHERS	96kbps 192Kbps 384kbps reserved
19:16	CODE OF PICTURE SIZE	0111 1011 OTHERS	176×44 352×288 reserved
15:10	TYPE OF Audio Codec	010101 OTHERS	MPEG4 Audio AAC-LC reserved
9	reserved	0	
8	variable bit rate FLAG	0 1	FIXED bit rate VARIABLE bit rate
7:4	bit rate CODE	0111 1001 OTHERS	64kbps 128kbps reserved
3	reserved	0	
2:0	sampling rate CODE	010 101 OTHERS	24kHz 48kHz reserved

FIG. 18

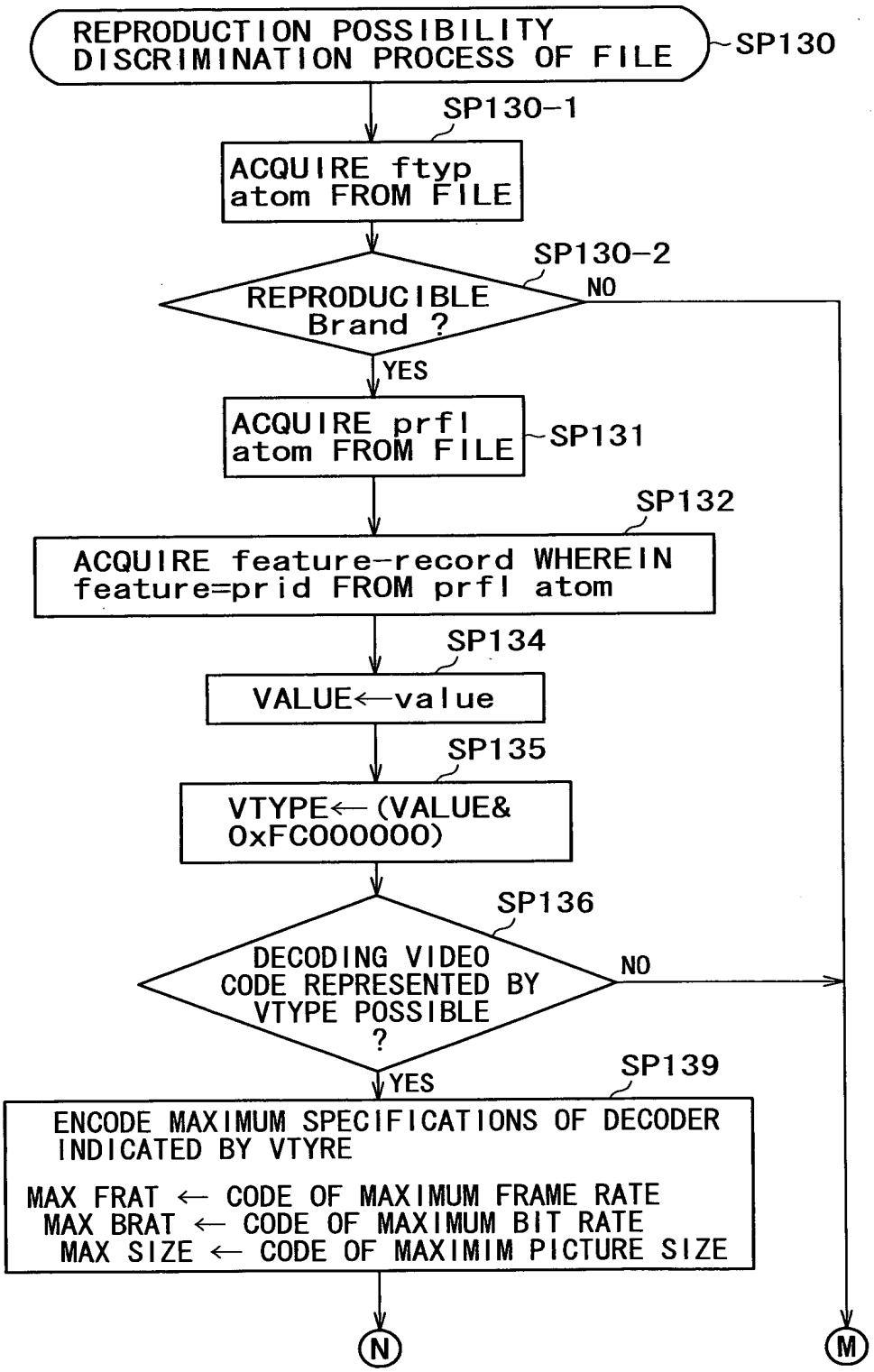

REPRODUCTION POSSIBILITY DISCRIMINATION PROCESS OF FILE
SP130
SP130-1
ACQUIRE ftyp atom FROM FILE
SP130-2
REPRODUCIBLE Brand ?
NO
YES
ACQUIRE prfl atom FROM FILE
SP131
SP132
ACQUIRE feature-record WHEREIN feature=prid FROM prfl atom
SP134
VALUE←value
SP135
VTYPE← (VALUE& 0xFC000000)
SP136
DECODING VIDEO CODE REPRESENTED BY VTYPE POSSIBLE ?
NO
YES
SP139
ENCODE MAXIMUM SPECIFICATIONS OF DECODER INDICATED BY VTYRE
MAX FRAT ← CODE OF MAXIMUM FRAME RATE
MAX BRAT ← CODE OF MAXIMUM BIT RATE
MAX SIZE ← CODE OF MAXIMIM PICTURE SIZE
N
M

FIG. 19

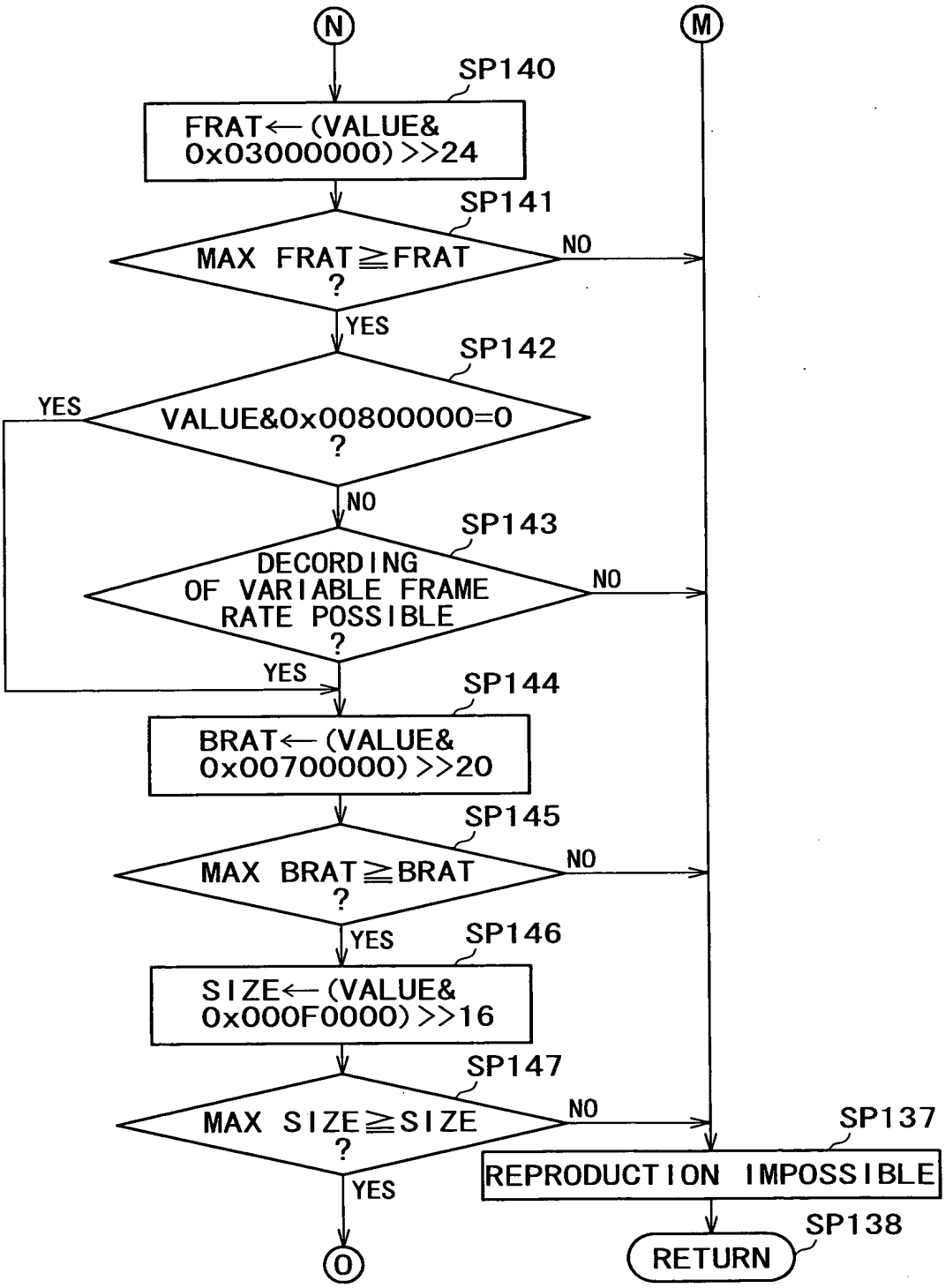

N
M
SP140
FRAT← (VALUE& 0x03000000) >>24
SP141
MAX FRAT≧FRAT ?
NO
YES
SP142
VALUE&0x00800000=0 ?
YES
NO
SP143
DECORDING OF VARIABLE FRAME RATE POSSIBLE ?
NO
YES
SP144
BRAT← (VALUE& 0x00700000) >>20
SP145
MAX BRAT≧BRAT ?
NO
YES
SP146
SIZE← (VALUE& 0x000F0000) >>16
SP147
MAX SIZE≧SIZE ?
NO
YES
SP137
REPRODUCTION IMPOSSIBLE
SP138
RETURN
O

FIG. 20

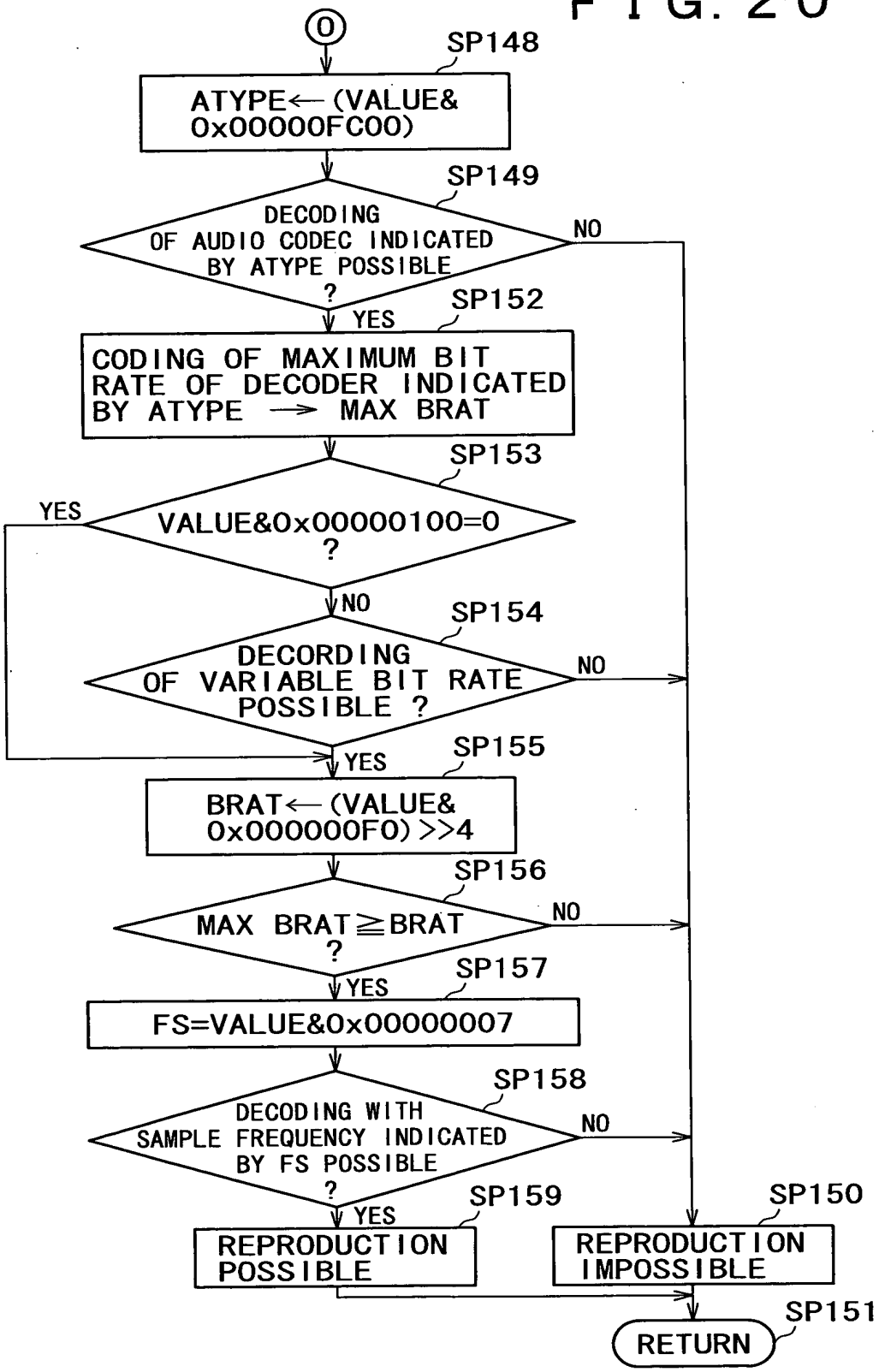

0
SP148
ATYPE← (VALUE& 0x00000FC00)
SP149
DECODING OF AUDIO CODEC INDICATED BY ATYPE POSSIBLE ?
NO
YES
SP152
CODING OF MAXIMUM BIT RATE OF DECODER INDICATED BY ATYPE → MAX BRAT
SP153
YES
VALUE&0x00000100=0 ?
NO
SP154
DECORDING OF VARIABLE BIT RATE POSSIBLE ?
NO
YES
SP155
BRAT← (VALUE& 0x000000F0) >>4
SP156
MAX BRAT≧BRAT ?
NO
YES
SP157
FS=VALUE&0x00000007
SP158
DECODING WITH SAMPLE FREQUENCY INDICATED BY FS POSSIBLE ?
NO
YES
SP159
REPRODUCTION POSSIBLE
SP150
REPRODUCTION IMPOSSIBLE
SP151
RETURN

FIG. 21

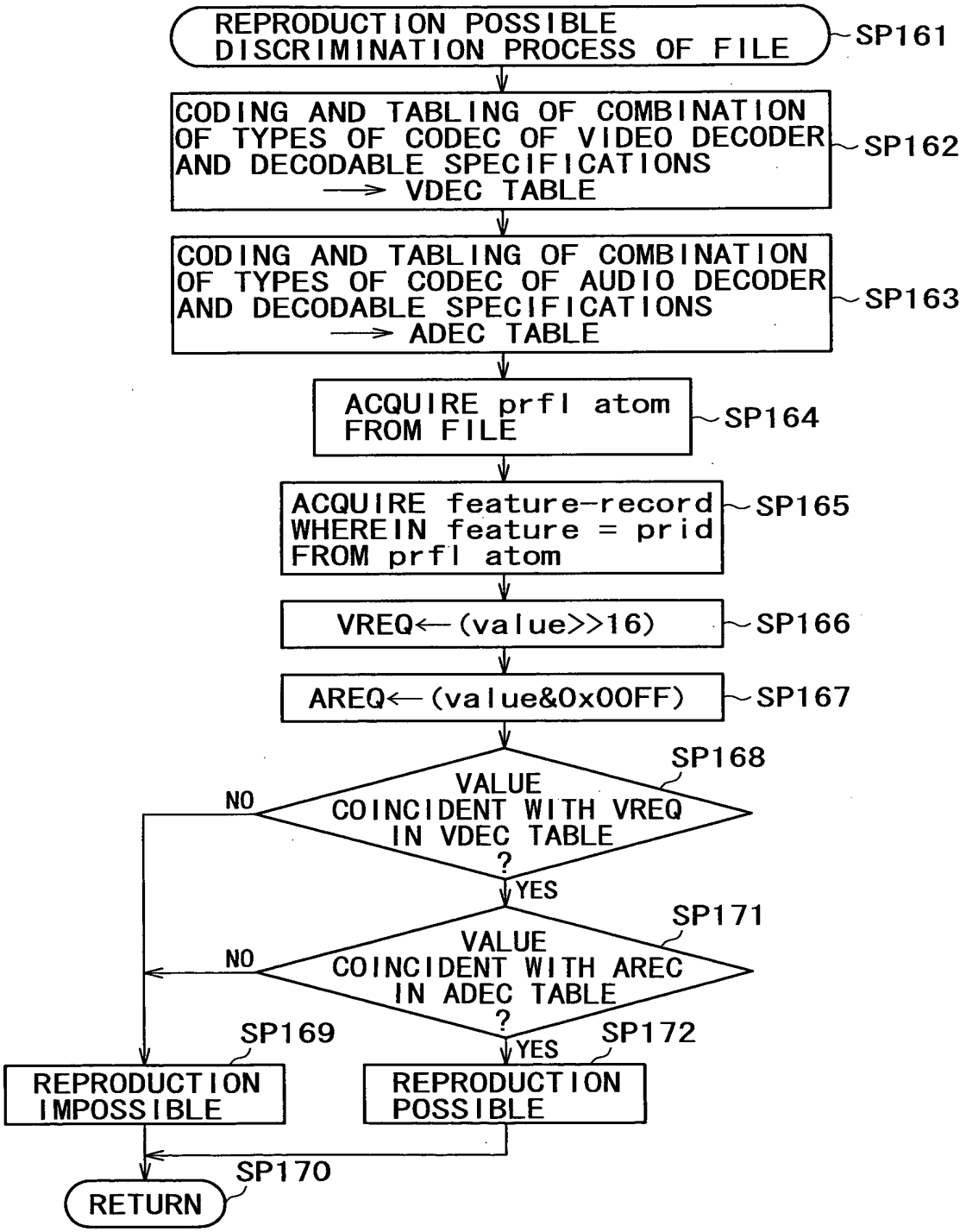

REPRODUCTION POSSIBLE DISCRIMINATION PROCESS OF FILE
SP161
CODING AND TABLING OF COMBINATION OF TYPES OF CODEC OF VIDEO DECODER AND DECODABLE SPECIFICATIONS ⟶ VDEC TABLE
SP162
CODING AND TABLING OF COMBINATION OF TYPES OF CODEC OF AUDIO DECODER AND DECODABLE SPECIFICATIONS ⟶ ADEC TABLE
SP163
ACQUIRE prfl atom FROM FILE
SP164
ACQUIRE feature-record WHEREIN feature = prid FROM prfl atom
SP165
VREQ←(value>>16)
SP166
AREQ←(value&0x00FF)
SP167
VALUE COINCIDENT WITH VREQ IN VDEC TABLE ?
SP168
NO
YES
VALUE COINCIDENT WITH AREC IN ADEC TABLE ?
SP171
NO
YES
REPRODUCTION IMPOSSIBLE
SP169
REPRODUCTION POSSIBLE
SP172
RETURN
SP170

FIG. 22

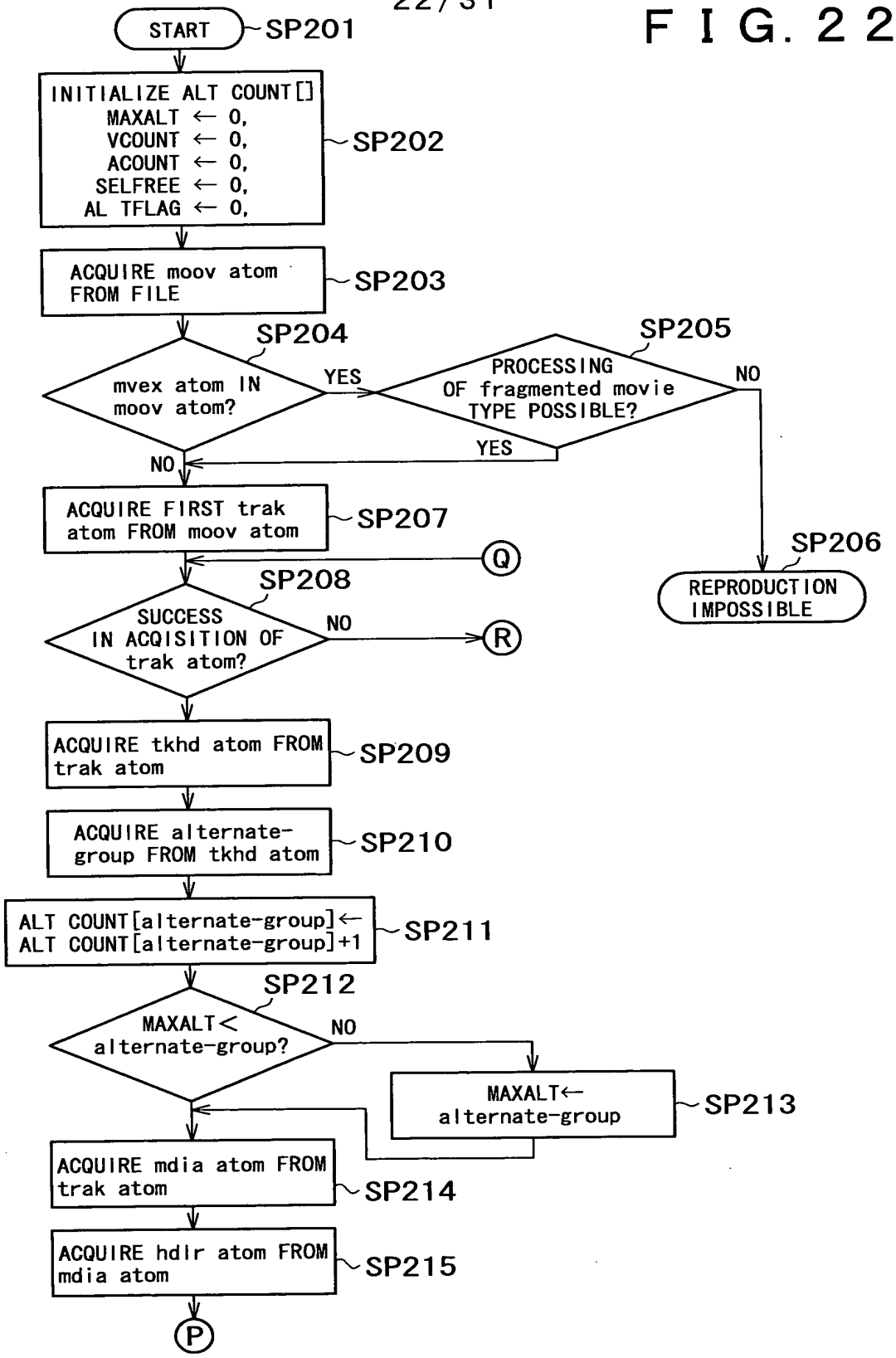

START
SP201
INITIALIZE ALT COUNT[]
MAXALT ← 0,
VCOUNT ← 0,
ACOUNT ← 0,
SELFREE ← 0,
AL TFLAG ← 0,
SP202
ACQUIRE moov atom FROM FILE
SP203
SP204
mvex atom IN moov atom?
YES
SP205
PROCESSING OF fragmented movie TYPE POSSIBLE?
NO
YES
NO
SP206
REPRODUCTION IMPOSSIBLE
ACQUIRE FIRST trak atom FROM moov atom
SP207
Q
SP208
SUCCESS IN ACQISITION OF trak atom?
NO
R
ACQUIRE tkhd atom FROM trak atom
SP209
ACQUIRE alternate-group FROM tkhd atom
SP210
ALT COUNT[alternate-group]← ALT COUNT[alternate-group]+1
SP211
SP212
MAXALT< alternate-group?
NO
MAXALT← alternate-group
SP213
ACQUIRE mdia atom FROM trak atom
SP214
ACQUIRE hdlr atom FROM mdia atom
SP215
P

FIG. 23

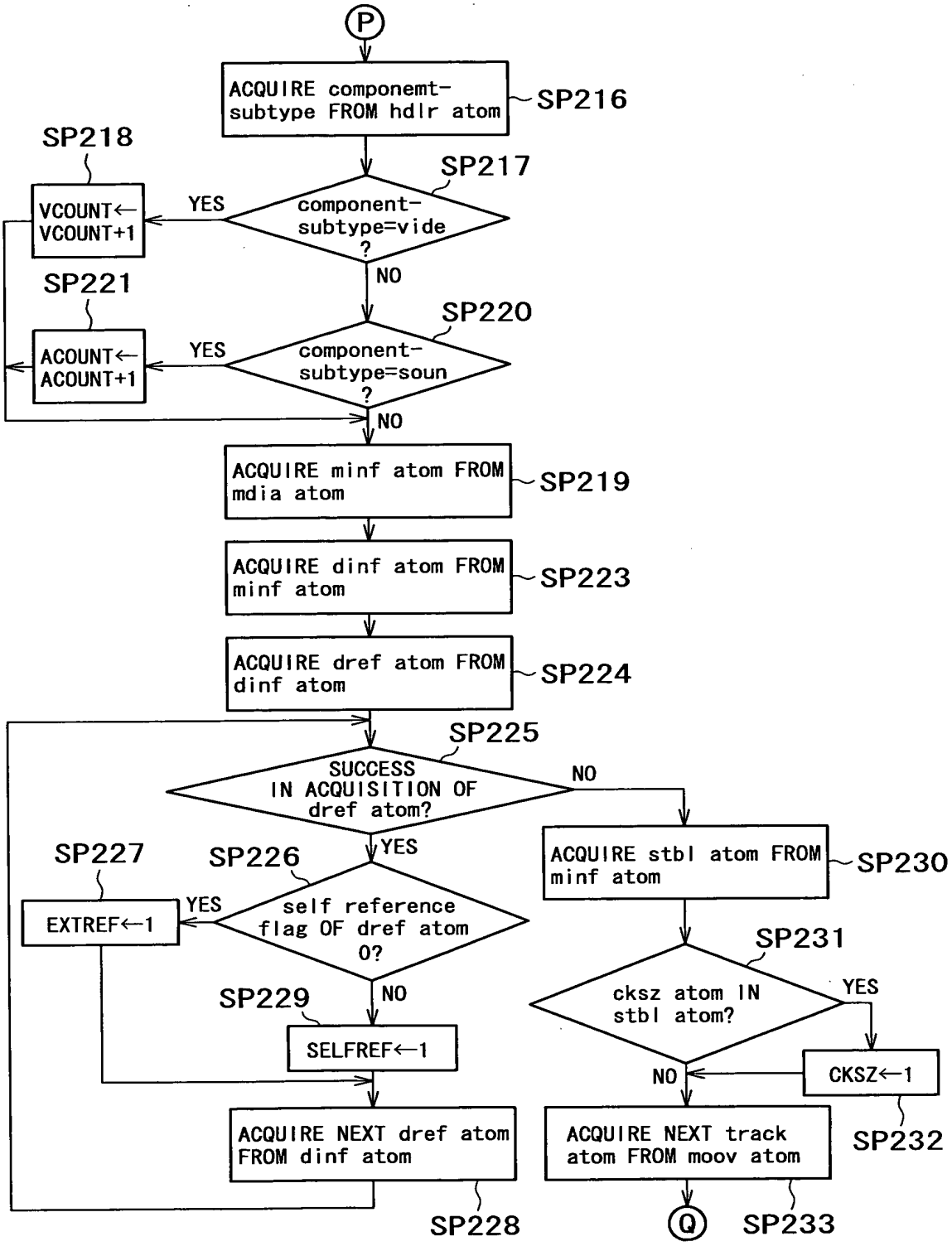

P
ACQUIRE componemt-subtype FROM hdlr atom
SP216
SP217
component-subtype=vide ?
YES
VCOUNT←VCOUNT+1
SP218
NO
SP220
component-subtype=soun ?
YES
ACOUNT←ACOUNT+1
SP221
NO
ACQUIRE minf atom FROM mdia atom
SP219
ACQUIRE dinf atom FROM minf atom
SP223
ACQUIRE dref atom FROM dinf atom
SP224
SP225
SUCCESS IN ACQUISITION OF dref atom?
NO
YES
SP226
self reference flag OF dref atom 0?
YES
SP227
EXTREF←1
NO
SP229
SELFREF←1
ACQUIRE NEXT dref atom FROM dinf atom
SP228
ACQUIRE stbl atom FROM minf atom
SP230
SP231
cksz atom IN stbl atom?
YES
CKSZ←1
SP232
NO
ACQUIRE NEXT track atom FROM moov atom
Q
SP233

FIG. 24

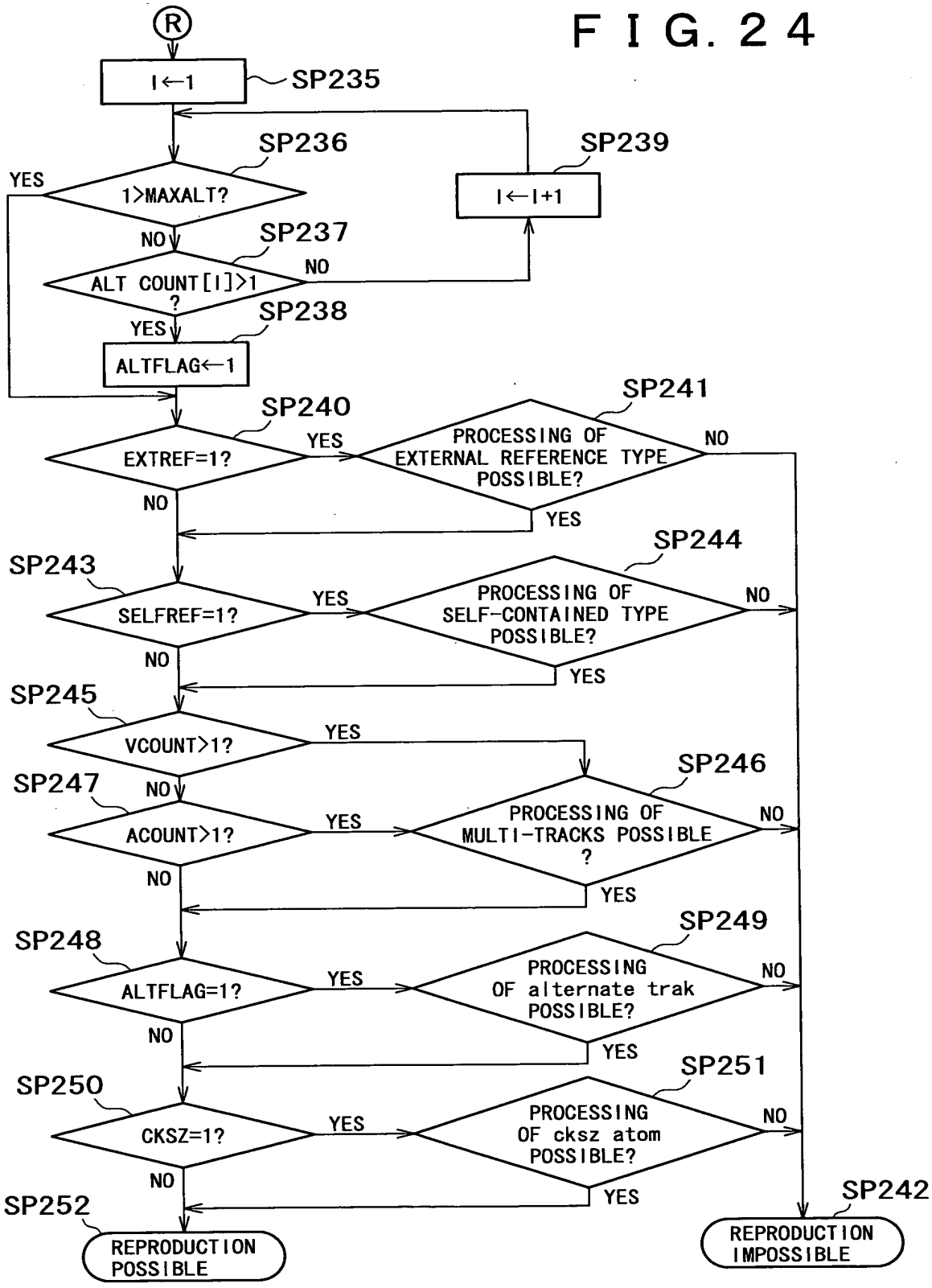

R
I←1
SP235
SP236
1>MAXALT?
YES
NO
SP237
ALT COUNT[I]>1 ?
NO
YES
SP238
ALTFLAG←1
SP239
I←I+1
SP240
EXTREF=1?
YES
NO
SP241
PROCESSING OF EXTERNAL REFERENCE TYPE POSSIBLE?
NO
YES
SP243
SELFREF=1?
YES
NO
SP244
PROCESSING OF SELF-CONTAINED TYPE POSSIBLE?
NO
YES
SP245
VCOUNT>1?
YES
NO
SP246
PROCESSING OF MULTI-TRACKS POSSIBLE ?
NO
YES
SP247
ACOUNT>1?
YES
NO
SP248
ALTFLAG=1?
YES
NO
SP249
PROCESSING OF alternate trak POSSIBLE?
NO
YES
SP250
CKSZ=1?
YES
NO
SP251
PROCESSING OF cksz atom POSSIBLE?
NO
YES
SP252
REPRODUCTION POSSIBLE
SP242
REPRODUCTION IMPOSSIBLE

FIG. 25

value	SIGNIFICANCE
frmv	Fragmented Movie Atoms PRESENT
mdtk	TRACK FOR MODIFICATION
altk	TRACK FOR ALTERNATIVE
exrf	EXTERNAL REFERENCE PRESENT
slrf	SELF-CONTAINMENT PRESENT
cksz	chunk size atom PRESENT

FIG. 26

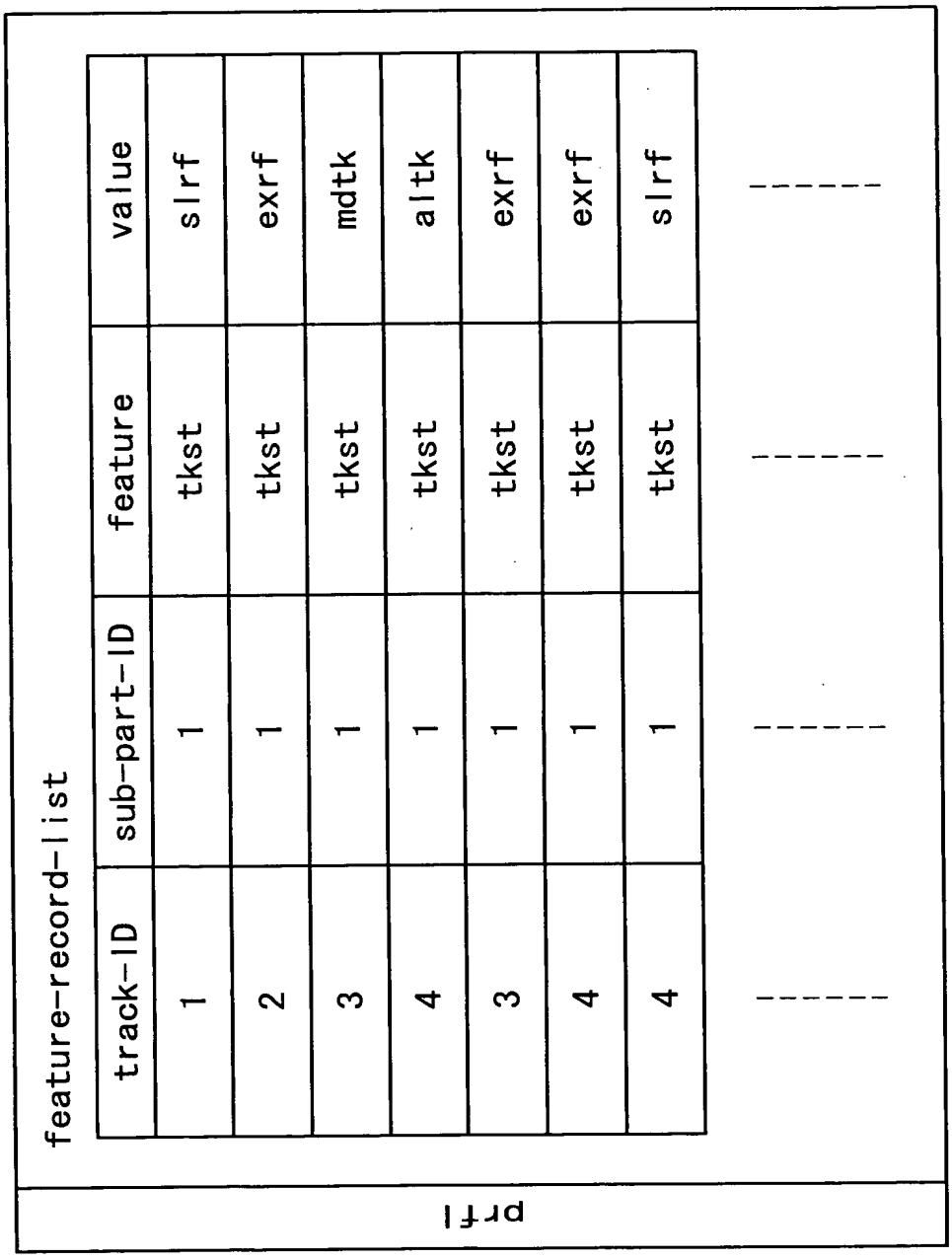

prfi
feature-record-list
track-ID
sub-part-ID
feature
value
1
1
tkst
slrf
2
1
tkst
exrf
3
1
tkst
mdtk
4
1
tkst
altk
3
1
tkst
exrf
4
1
tkst
exrf
4
1
tkst
slrf

FIG. 27

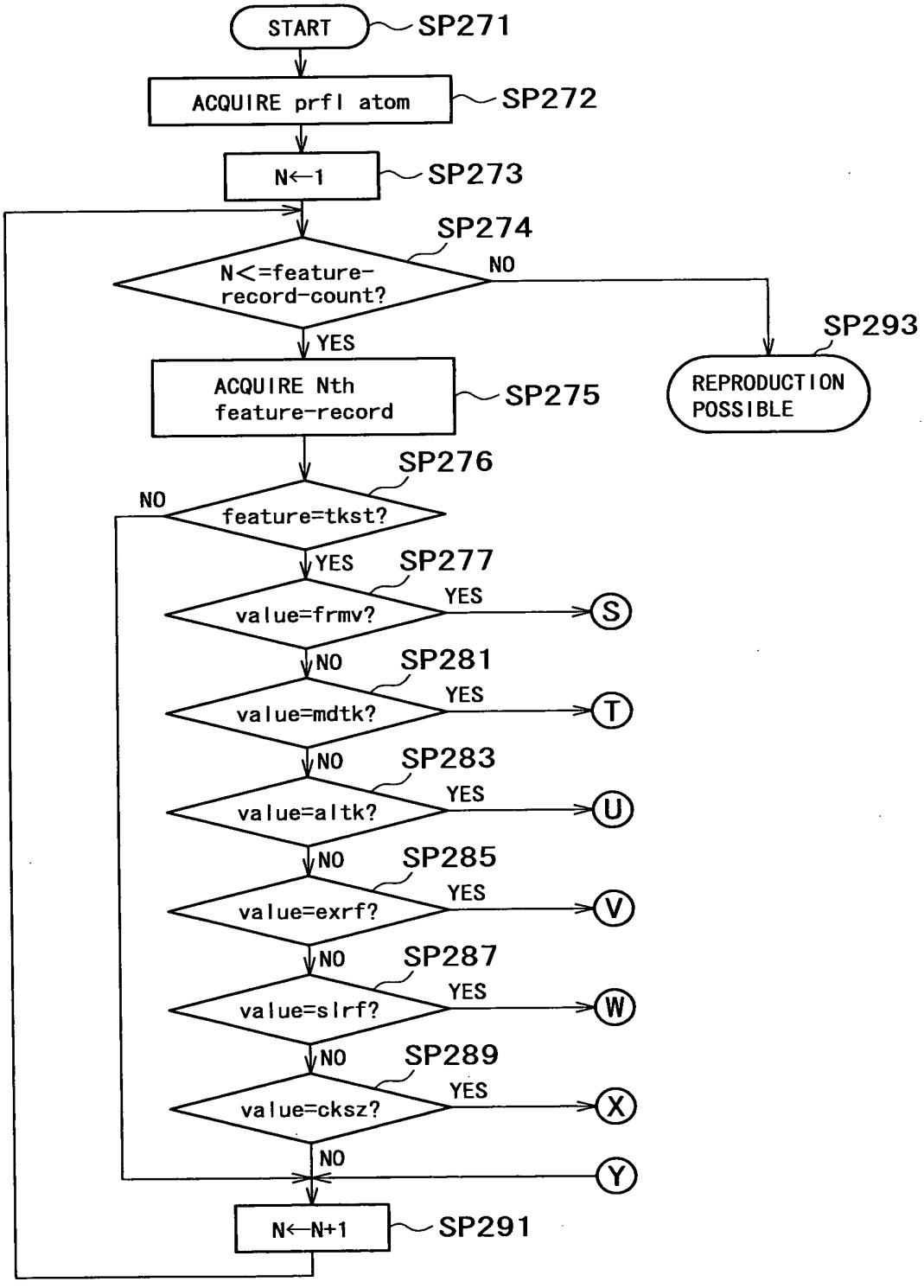

START
SP271
ACQUIRE prfl atom
SP272
N←1
SP273
SP274
N<=feature-record-count?
NO
YES
SP293
REPRODUCTION POSSIBLE
ACQUIRE Nth feature-record
SP275
SP276
NO
feature=tkst?
YES
SP277
value=frmv?
YES
S
NO
SP281
value=mdtk?
YES
T
NO
SP283
value=altk?
YES
U
NO
SP285
value=exrf?
YES
V
NO
SP287
value=slrf?
YES
W
NO
SP289
value=cksz?
YES
X
NO
Y
N←N+1
SP291

FIG. 28

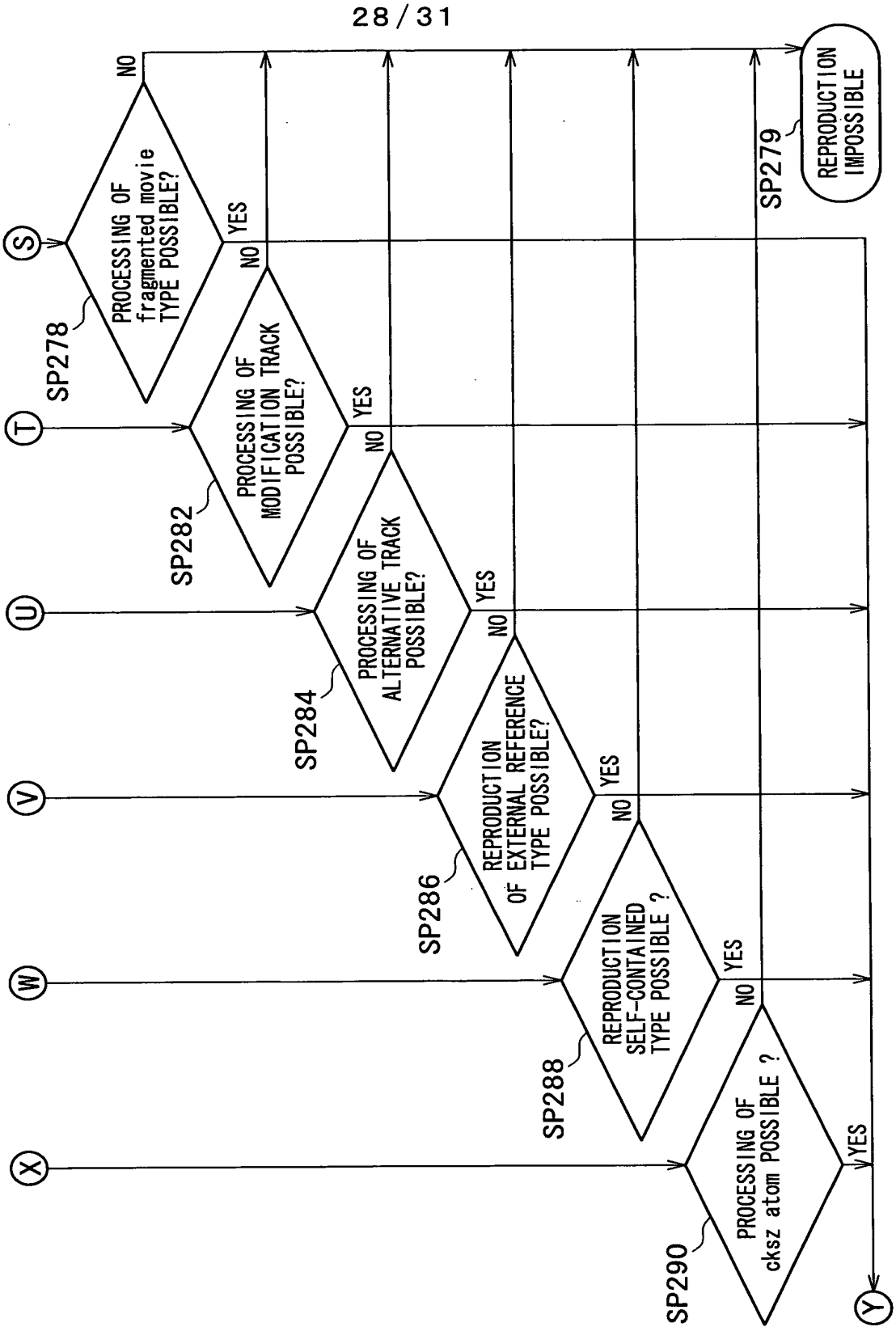

S
PROCESSING OF fragmented movie TYPE POSSIBLE?
SP278
NO
YES
T
PROCESSING OF MODIFICATION TRACK POSSIBLE?
SP282
NO
YES
U
PROCESSING OF ALTERNATIVE TRACK POSSIBLE?
SP284
NO
YES
V
REPRODUCTION OF EXTERNAL REFERENCE TYPE POSSIBLE?
SP286
NO
YES
W
REPRODUCTION SELF-CONTAINED TYPE POSSIBLE ?
SP288
NO
YES
X
PROCESSING OF cksz atom POSSIBLE ?
SP290
NO
YES
Y
SP279
REPRODUCTION IMPOSSIBLE

FIG. 29

feature=fnsc	
Bit	SIGNIFICANCE OF EACH Bit (FLAG)
31	Fragmented Movie TYPE INCLUDED
30:24	reserved
23	TRACK WHICH MODIFIES MAIN VIDEO TRACK
22	TRACK WHICH MODIFIES MAIN AUDIO TRACK
21	ALTERNATIVE TRACK FOR MAIN VIDEO TRACK
20	ALTERNATIVE TRACK FOR MAIN AUDIO TRACK
19	MAIN VIDEO TRACK IN EXTERNAL REFERENCE TYPE
18	MAIN AUDIO TRACK IN EXTERNAL REFERENCE TYPE
17	Chunk Size Atom USED
16:0	reserved

FIG. 30

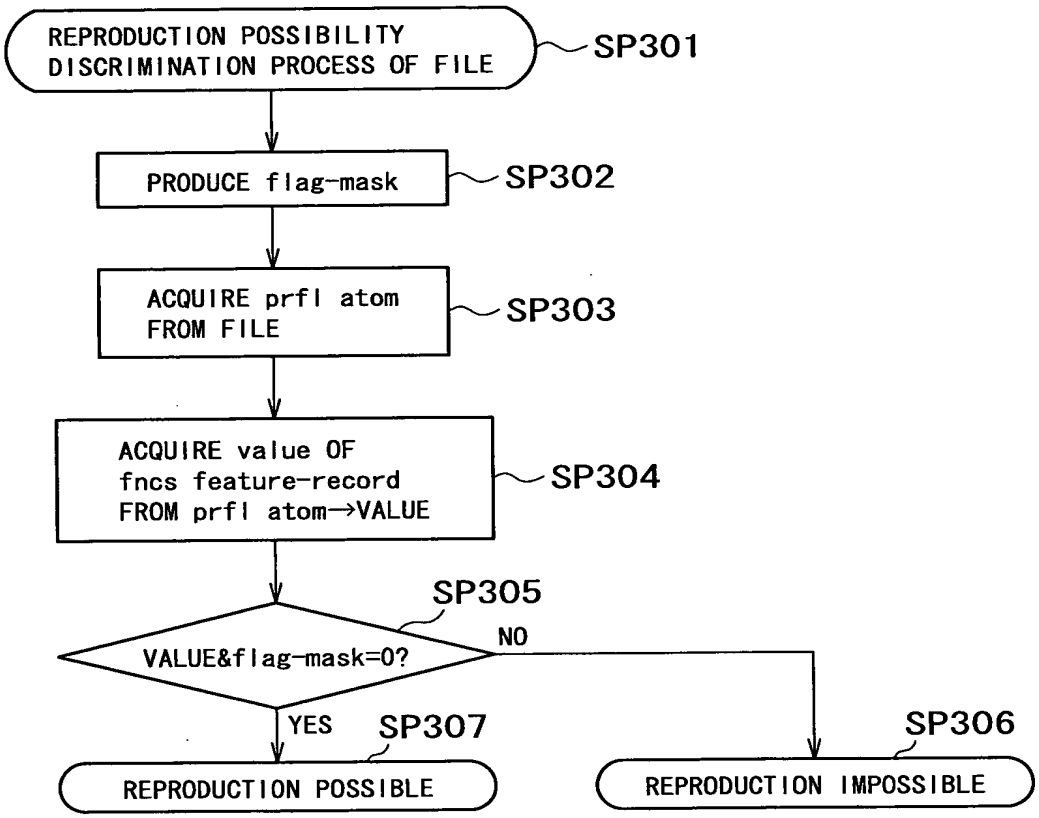
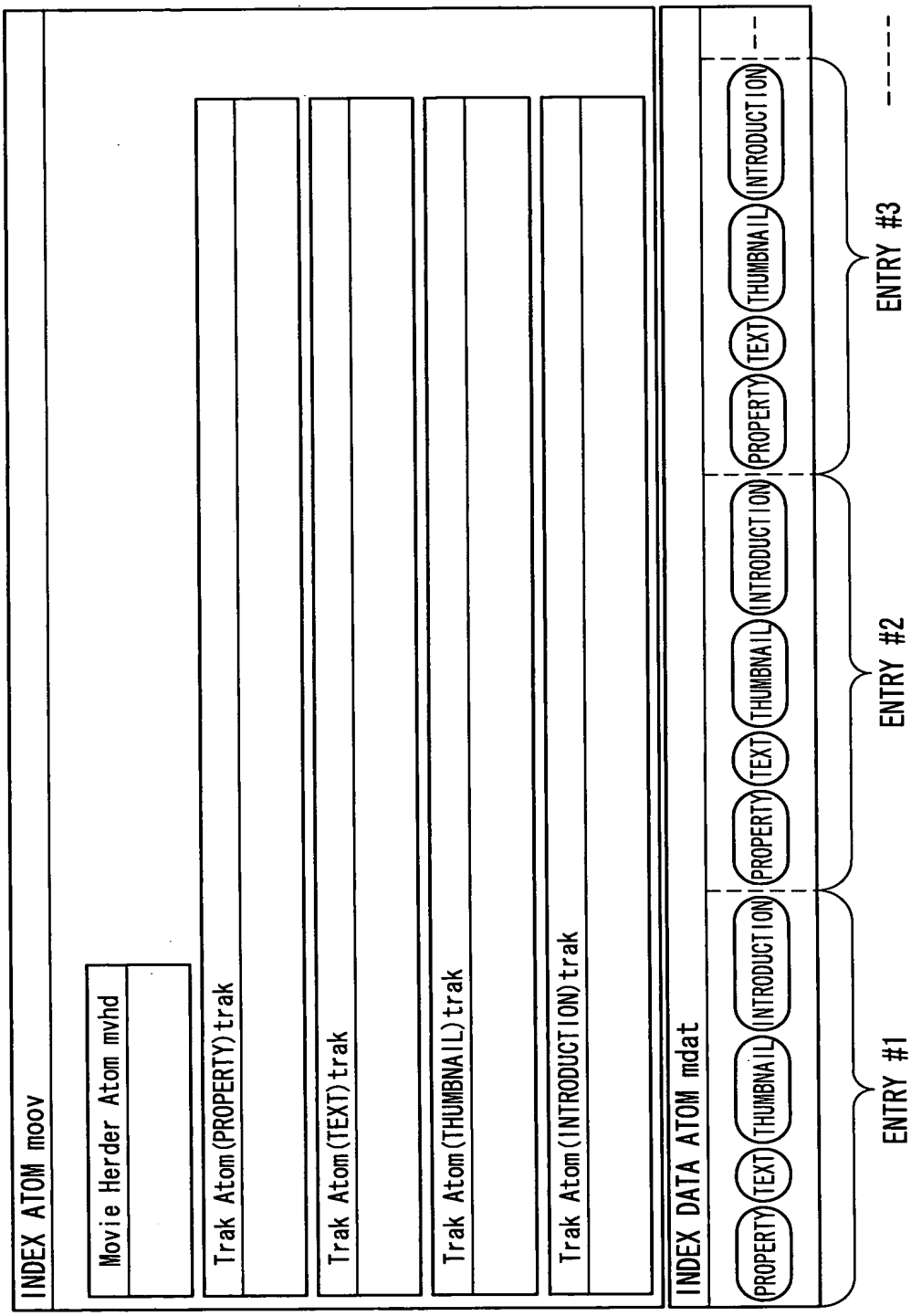

REPRODUCTION POSSIBILITY DISCRIMINATION PROCESS OF FILE
SP301
PRODUCE flag-mask
SP302
ACQUIRE prfl atom FROM FILE
SP303
ACQUIRE value OF fncs feature-record FROM prfl atom→VALUE
SP304
SP305
VALUE&flag-mask=0?
NO
YES
SP307
SP306
REPRODUCTION POSSIBLE
REPRODUCTION IMPOSSIBLE

FIG. 31


INDEX ATOM moov
Movie Herder Atom mvhd
Trak Atom(PROPERTY)trak
Trak Atom(TEXT)trak
Trak Atom(THUMBNAIL)trak
Trak Atom(INTRODUCTION)trak
INDEX DATA ATOM mdat
PROPERTY
TEXT
THUMBNAIL
INTRODUCTION
PROPERTY
TEXT
THUMBNAIL
INTRODUCTION
PROPERTY
TEXT
THUMBNAIL
INTRODUCTION
ENTRY #1
ENTRY #2
ENTRY #3